EUROCONTROL

EUROCONTROL Specification for Data Assurance Levels

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EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL Specification for Data Assurance Levels

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Abstract

This EUROCONTROL Specification provides the objectives which should be met in order to comply with some specific provisions of the Commission Regulation (EU) 73/2010 laying down requirements on the quality of aeronautical data and aeronautical information for the single European sky.

Keywords

SES | Implementing Rule | Interoperability | ADQ

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DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

Edition Number	Edition Date	Reason for Change	Pages Affected
1.1	28-Mar-18	Main reasons for change: • chapters “Data Processing Assurance” and “Tools and Software Requirements” revised by referencing to tool qualification specifications covered by Eurocae ED76A. • rationalisation, consistency of some objectives • removal of initial Annex J content, insertion of list of changes. Summary of changes see revised Annex J.	All
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EXECUTIVE SUMMARY

The European Commission Regulation No 552/2004 mandates the development of Interoperability Implementing Rules (IR) together with EUROCONTROL Specifications and, as applicable, supporting Guideline documents for interoperability of the European ATM network, which includes Aeronautical Data Quality (ADQ). The EUROCONTROL Standards Development Process defines the processes and templates to be used in the development of the such material. The EUROCONTROL Standards development process has been applied to the development of the Specification for Data Assurance Levels (DAL Specification).

The DAL Specification is written as a EUROCONTROL Specification primarily to address the Commission Regulation (EU) No 73/2010[1] in respect of meeting data quality requirements for the processing of aeronautical data from origination through to publication by the Aeronautical Information Service Provider (AISP) to the next intended user. Its contents are considered as a possible Means of Compliance, and were developed under full consideration of the Conformity Assessment (CA) Guidelines to support the achievement of the relevant provisions.

The data integrity levels are defined in the ICAO Annexes and captured and expanded within the European Harmonised List of the Data Quality Requirements Specification. The DAL Specification defines data quality assurance objectives for each data integrity level and addresses specified provisions of the Commission Regulation (EU) No 73/2010. It is an important document for all parties and stakeholders implementing and operating in accordance with the Commission Regulation (EU) No 73/2010. This specification is developed as a single document, however, it should be read in conjunction with other relevant documents and EUROCONTROL Specifications, e.g. Data Quality Requirements Specification and the Data Origination Specification.

The primary intention of the DAL Specification is to address Article 6(2) of the Commission Regulation (EU) No 73/2010 and the requirements in Annex IV, Part B. However, the Specification also covers Articles 4 through 10 and Article 13 by providing supplementary objectives for them, but only in so far as is necessary to address the data quality issues related to these provisions. The rationale for this is discussed further herein. The following articles of the Commission Regulation (EU) No 73/2010 are not covered: Conformity or suitability for use of constituents (Article 11), Verification of systems (Article 12), Transitional provisions (Article 14) and Entry into force and application (Article 15).

[1] as amended by Commission Implementing Regulation (EU) No 1029/2014

1 INTRODUCTION

1.1. Background

1.1.1 Overview

Commission Regulation (EU) No 73/2010 (hereinafter referred as ADQ IR) mandates provisions on stakeholders participating in the processing of aeronautical data and information. The ADQ IR was founded on the need to resolve known deficiencies with existing aeronautical data processing. The deficiencies in the current system include safety and security issues in achieving the target levels of data quality necessary to support aircraft operations and air traffic management safety. Some of these deficiencies are attributed to the manual processing of data.

The need to provide data and information of a required quality to ensure safe and secure operation has led to the trend within the aeronautical industry to deploy more complex automation. Historically, operational incidents and accidents in the aeronautical industry rarely result solely from erroneous data. However, erroneous or anomalous data can be cited as a contributory factor for some of these incidents/accidents, e.g. the Cali accident, Flight 965, 20 December 1995, where data inconsistency contributed to pilot confusion which in turn led to the loss of the aircraft. The impact of erroneous and/or incomplete data on safe aircraft operations and the increasing use of data in automated safety related applications necessitate the guaranteed production of high quality data.

The DAL Specification provides all parties from origination to publication with objectives that elaborate on ICAO requirements for data quality and in particular Article 6(2) of the ADQ IR. Objectives are defined for each ICAO Annex 15 Data Integrity Level and satisfaction of these objectives constitutes an essential part of the assurance of data quality.

Wherever possible, the development of the DAL Specification reused extant material in addressing the provisions of the ADQ IR. The material used included inter alia, EUROCONTROL CHAIN documents and security guidance material, relevant ICAO Annexes and Guidance Material, industry standards and ISO standards for information security.

1.1.2 EUROCONTROL Specifications

Under the EUROCONTROL Regulatory and Advisory Framework (ERAF), a EUROCONTROL Specification is defined as:

> *Detailed technical specifications for physical characteristic, configuration, material, performance, personnel or procedure, the compliance with which is recognised as meeting requirements of safe and efficient systems and services related to ATM in the EUROCONTROL Member States, as defined by EUROCONTROL regulatory material.*

The ERAF introduced a set of documents comprising the EUROCONTROL Rule (mandatory), Specification (voluntary) and Guidelines (voluntary). These documents aim to support the Single European Sky (SES) regulatory material, notably the SES Implementing Rules such as the ADQ IR. EUROCONTROL specifications are developed in accordance with the EUROCONTROL Notice of Proposed Rulemaking (ENRPM) process.

The DAL Specification is written as a EUROCONTROL Specification primarily to address Article 6(2) of the ADQ IR and the requirements in Annex IV, Part B. However, the Specification also covers ADQ IR Articles 4 through 10 and Article 13 by providing supplementary objectives for them, but only in so far as is necessary to address the

data quality issues related to these provisions. It has been developed under full consideration of the ADQ IR provisions and is, therefore, considered as a possible Means of Compliance.

The DAL Specification content is voluntary in status but National authorities may decide to employ the specification either as voluntary material or to implement it as mandatory material within their own regulatory frameworks. The manner in which they are used will depend on nationally assessed requirements.

1.1.3 Community Specifications and EUROCONTROL Specifications

In the context of the SES interoperability Regulation, EUROCONTROL Specifications may be recognised as offering a MoC with identified SES regulatory material, when they provide an implementation solution for the regulatory material and if they can be traceable to the provisions. The reference numbers of these specifications are then published in the Official Journal of the European Union (OJEU), recognising them as Community specifications. When an EATMN system achieves compliance with such specifications, it is then presumed to conform to relevant regulatory provisions.

1.2. Purpose

The primary aim of the DAL Specification is to address Article 6(2) of the ADQ IR:

> *When providing aeronautical data and/or aeronautical information, the parties referred to in Article 2(2) shall comply with the evidence requirements specified in Annex IV, Part B.*

As such, the Data Assurance Level (DAL) Specification defines objectives that address the data quality requirements of the ADQ IR provisions. However, it is not the purpose of the DAL Specification to address Article 6(1) of the ADQ IR, which concerns the definition of data quality requirements. A further specification, the EUROCONTROL Specification for Data Quality Requirements (DQR), has been developed to act as a means of compliance for this provision.

The DQR Specification makes use of the Data Integrity Levels (DILs) defined in ICAO Annex 15. The three DALs defined herein map to the DILs as follows and define the objects for data quality in respect to demonstrating Article 6(2) of the ADQ IR.

Data Integrity Level	Data Assurance Level
Critical	DAL 1
Essential	DAL 2
Routine	DAL 3

1.3. Scope

The structure and content of the DAL Specification corresponds directly to the order of the provisions as presented in the ADQ IR. The primary intention of the DAL Specification is to address Article 6(2) of the ADQ IR and the requirements in Annex IV, Part B. However, the Specification also covers ADQ IR Articles 4 to 10 and Article 13 by providing supplementary objectives for them but only in so far as necessary to address the data quality issues related to these provisions. The rationale for this is discussed further in section 2.4.3.

> **NOTE 1***: **Article 6(1)** of the ADQ IR on the definition of data quality requirements is not within the scope of the DAL Specification. The provisions of Article 6(1) are covered by the DQR Specification.*
>
> **NOTE 2**: ***Articles 11 and 12** of the ADQ IR 'Conformity or suitability for use of constituents' and 'Verification of systems' are not addressed by the DAL*

Specification as these provisions relate to the assessment of compliance with the ADQ IR. The EUROCONTROL Guidelines on Conformity Assessment provide guidance on conformity assessment of EATMN systems and constituents with the essential requirements (ERs) and all IRs relevant to the interoperability regulation EC Reg. No. 552/2004.

NOTE 3: ***Chapter V, Articles 14 and 15*** *The Final Provisions, both the Transitional provisions and Entry into force and application, are not within the scope of the DAL Specification as these provisions relate to the transitional arrangements and introduction of the ADQ IR.*

The ADQ IR further defines the scope of application in terms of the following as discussed in the next few sections.

- Applicable Aeronautical Data / Information, i.e. the Subject Matter.
- Applicable Systems.
- Applicable Parties.
- Applicable Aeronautical Data Chain stages included, i.e. the Boundary.

1.3.1 Subject Matter

The ADQ IR identifies the scope of data included or the subject matter in Article 2(1) and Article 3(7).

1.3.2 Aeronautical Data Chain Boundary

The scope of the Aeronautical Data Chain applicable to the DAL Specification is from request to origination (instigated by the parties) to publication to the next intended user.

The ADQ IR defines the next intended user in Article 2(3) and Article 3(14).

1.3.3 Implementation

Directives and provisions for the transitional planning and implementation activities are outside the scope of this specification document.

1.4. Limitations

1.4.1 Safety

Full compliance with the DAL specification does not mean that all aspects of safety assurance with respect to the use of data especially in end-user applications have been addressed (see section 2.1).

Furthermore, the scope of the Aeronautical Data Chain covered by the ADQ IR includes the data chain stages of data origination through to publication by AISPs to the next intended user. This places a limitation on the approach to satisfying the overall safety integrity requirements for the use of data in the operational context.

Within the scope of the DAL Specification this is acknowledged as a constraint on the current approach applied to the allocation of DALs.

1.4.2 Security

Assuring the security of information is an essential part of assuring the quality of data and hence addressing the safety requirements for data. However, security considerations also include:

- **Confidentiality**: The AIP once published is a public document and, hence, has no confidentiality issues. CHAIN 0029 paragraph 3.4.4, however, suggests that in order to deter malicious interference, it is important to protect data/information in the communication and processing activities before publication so that it cannot be easily intercepted.
- **Authentication**: It is important for security that the sender and receiver of data can each authenticate the identity of the other as being approved.
- **Non-repudiation**: Non-repudiation gives assurance that the sender of information is provided with proof of delivery and the recipient is provided with proof of the sender's identity, so neither can later deny having processed the information (US NIST SP800-53).Whilst the end user of AIP data is not subject to this specification, it is necessary that the distributor of the data should be able to receive the required authentication and non-repudiation messages from the end user.

1.5. Applicability

The DAL Specification is applicable to all parties as identified by the ADQ IR. The scope of the ADQ IR is wide ranging and applies to EATMN systems, their constituents and associated procedures involved in the origination, production, storage, handling, processing, transfer and distribution of aeronautical data and information. However, not all objectives defined herein are applicable to all parties. The DAL Specification provides guidance for applicability of groups of objectives to parties (see section 3.5). However, individual parties will also need to make a judgement regarding the applicability of the objectives to the activities of their organisation.

1.5.1 Applicable Systems

The ADQ IR defines the systems covered in the first paragraph of Article 2(1).

1.5.2 Parties

The ADQ IR defines the regulated parties (hereafter simply called 'parties') in Article 2(2).

1.6. Conventions

Several conventions are used within the DAL Specification and are summarised in the following paragraphs.

1. The DAL is defined at three levels which are commensurate with the Data Integrity Levels (DILs) defined by ICAO Annex 15:

DAL	DIL	DIL definition (from ICAO Annex 15)
DAL 1	Critical	There is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.
DAL 2	Essential	There is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.
DAL 3	Routine	There is a very low probability when using routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.

2. The following verb conventions are used within this document:

   - Objectives using the operative verb "**shall**" must be implemented to achieve the minimum objectives of this specification.
   - Objectives using the operative verb "**should**" are *recommended* to achieve the best possible implementation of this specification.
   - Objectives using the operative verb "**may**" indicate *option*s.

3. The designated DAL directives for each objective are:

●	the objective shall be satisfied with independence, see 2.4.4, below;
O	the objective shall be satisfied;
Blank	satisfaction of the objective is at stakeholders discretion;

4. Every objective within the DAL Specification is identified using the reference system below (see section 3.4):

   DAL-[Fn]-[nnn]

   Where:
   - **DAL** represents Data Assurance Level;
   - **[Fn]** defines the functional area (refer to section 3.4 and ANNEX H FUNCTIONAL LEVELS;
   - **[nnn]** is a numeric identifier for each functional category.

1.7. Reference Material

Please refer to ANNEX E for relevant material used for the development of this document.

1.8. Abbreviations

Please refer to ANNEX F for the abbreviations used in this document.

1.9. Definitions

Please refer to ANNEX G for the definitions used in this document.

1.10. Document Structure

The DAL Specification is structured as shown in Figure 1:

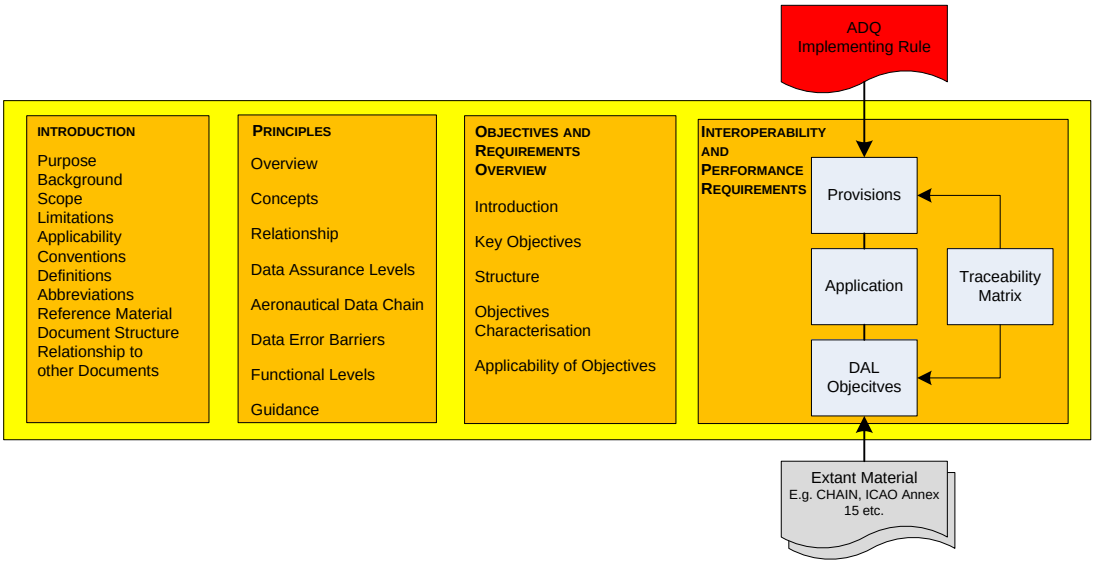

Figure 1: DAL Specification Outline Document Structure

The individual sections of the DAL Specification are:

Executive summary – provides a foreword and context

Section 1 presents the introduction material

Section 2 presents the principles of data assurance levels, Aeronautical Data Chain, data chain barrier model, and Functional Levels

Section 3 provides the presentation structure associated with defining the DAL objectives

Section 4 defines the interoperability and performance requirements to address the ADQ IR as well as the quality management, safety and security requirements

Section 5 addresses the provisions of Article 13 Additional requirements

ANNEX A provides the tables for Configuration Control

ANNEX B provides the Conformance Statement for the objectives of this Specification

ANNEX C contains a traceability matrix between the provisions of the ADQ IR and the relevant requirements included in this Specification

ANNEX D provides supporting information on the procedures to update this Specification

ANNEX E provides references to documents used in this Specification

ANNEX F presents a table of abbreviations used in this Specification

ANNEX G includes a definition of relevant terms used in this Specification

ANNEX H provides supporting information on Functional Levels

ANNEX I provides supporting information on contents of main evidences referred to in this Specification

ANNEX J provides the list of amendments.

1.11. Relationship to other Documents

The relationship between the DAL Specification and other documents is presented in **Figure** 2.

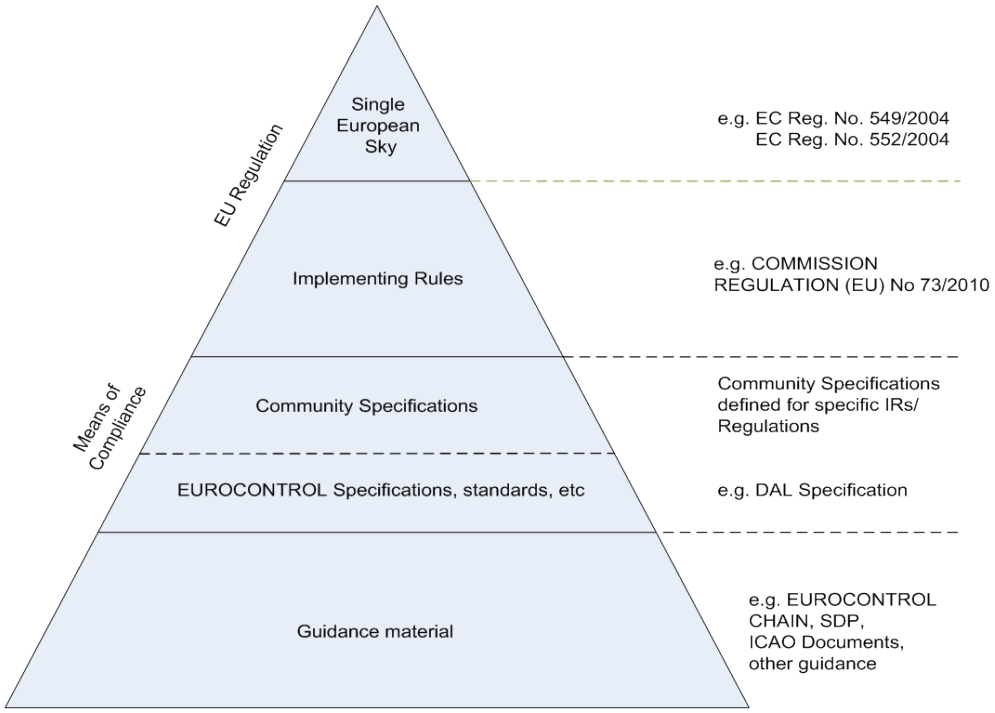

Figure 2: Relationship of the DAL Specification to other documents

The DAL Specification supports the ADQ IR by defining the objectives to be achieved for each of the 3 Data Integrity Levels defined in ICAO Annex 15. The DAL Specification uses, as appropriate, extant material from EUROCONTROL, industry standards and regulations applicable to the processing of aeronautical data and information.

Guidance Material will be provided in future editions of this specification. The intention is to provide support for the DAL Specification objectives in terms of additional detailed technical information and possible solutions. This information will allow the relevant parties to plan, implement and operate their processes and procedures.

2 PRINCIPLE CONCEPTS

2.1. Overview

The primary intention of the DAL Specification is to address Article 6(2) of the ADQ IR and the requirements in Annex IV, Part B. It also provides an approach to support the demonstration of, in a non-quantified manner, the data integrity requirements (DIL) defined in ICAO Annex 15 and the Harmonised List (Annex 7 of the DQR Specification).

Data integrity is defined numerically in ICAO Annex 15 and is often equated by the end user to safety integrity. Given that the acceptable occurrence rate for errors in essential/critical data is very small, then a qualitative method is needed for assuring data for use in safety related ATM applications, which addresses all aspects of data quality that may affect safety. Thus the DAL concept uses the same philosophy that is applied to software or procedural assurance. This is based on the assertion that similar types of hazards and consequences are found in data use as with software or procedures in supporting aircraft and air traffic operations.

The ADQ IR identifies:

- Article 6(1) (Annex IV, Part A) – which addresses the specification of Data Quality Requirements (DQRs)
- Article 6(2) (Annex IV, Part B) - which addresses the evidence requirements to demonstrate compliance with the provisions of the ADQ IR

Consequently, the DQR and DAL Specifications were developed to address the provisions of Annex IV Part A and B respectively in more detail.

It should be noted that, on its own, compliance with the DAL does not address all of the specific controls that may be required by an individual party to assure data quality. The assurance of safety with respect to data use and subsequent handling rests with data end-users (e.g. ANSPs, Aircraft Operators, etc.) who are responsible for both maintaining the integrity of the data and assuring correct use. However, AISP must still assure the adequacy of the service provided and the data quality as delivered to the next intended user.

Aeronautical Information provision is a live operational service and there are a number of ways that this service could fail, which could have an impact on ATM safety, including:

- Publication of incorrect data items or failure to update amended data items
- Inconsistent publication of data items
- Loss of dynamic data updates (e.g. loss of all NOTAM)

Article 10 of the ADQ IR mandates Safety Assessments, including hazard analysis and risk assessments, before any change to the existing systems or the introduction of new systems. However, it is not always possible for parties to the ADQ IR to conduct safety assessments on the use of data within ATM services or on how data is handled by the next intended user, as this is the responsibility of the data end-users. Yet, the parties must demonstrate that the data provision service meets agreed levels of performance and data quality, which are based on the impact on aircraft safety of failures such as those listed above.

The DAL Specification supports the parties in demonstrating compliance with the safety requirements by defining the objectives for the data processes that the parties follow, which in turn are used to assure the quality of the data provided. As there are many different, but equally valid, approaches to assuring data quality it is not feasible to construct a specification that is specific enough for every party. In this respect

objectives are also defined to ensure that the specific approach adopted by a party is appropriately analysed and reviewed. It remains the responsibility of individual parties (as overseen by the National authorities) to justify the adequacy of their processes in respect of meeting the DQRs.

2.2. Concepts

The concepts presented in this DAL Specification are designed to assist stakeholders, in defining compliant solutions to the provisions in the ADQ IR in relation to the assurance of data quality.

The concepts are:

a) **Data Assurance Levels (DALs),** providing a framework in which the three defined data integrity levels are addressed against the ADQ IR provisions.

b) **Aeronautical Data Chain** stages covering the whole data lifecycle from data origination through to end use.

c) **Data Error Barriers** used as a means of identifying and mitigating data errors at key points in the Aeronautical Data Chain.

d) **Functional Levels** within the parties to the ADQ IR or providers of data that can influence the overall resulting data quality.

2.3. Relationship

The relationship between these concepts is presented in Figure 3. In principle, objectives are defined for each **Data Assurance Level** at each stage of the **Aeronautical Data Chain** based on the **Data Error Barriers** employed at each **Functional Level** in the organisation.

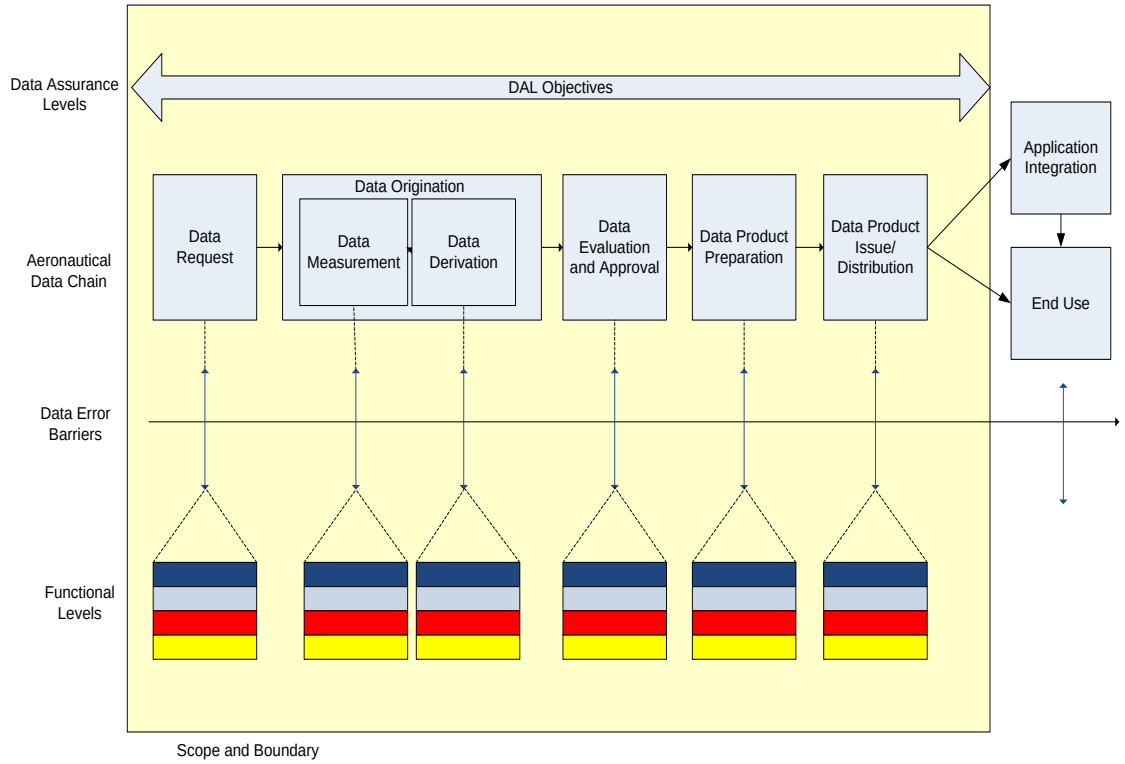

Figure 3: Relationship between the Concepts

The DAL objectives cover the same scope of the Aeronautical Data Chain as the ADQ IR. The Data Error Barriers were identified for each Aeronautical Data Chain stage, but are not documented in the DAL Specification as only the resultant DAL objectives are of relevance. Depending on a party's scope of operation within the chain, they may opt to consider a strategy of defining more than one data error barrier. For example, the Data Validation/Verification stage may include the following barriers to data error:

a) Data transfer integrity mechanisms.

b) Originator validity / Suitability for publication checks.

c) Scope of supply / Data quality checks.

d) Data completeness / correctness / Procedural checks.

The barriers may be implemented by one or more of four Functional Levels representing the various elements that contribute to the overall processing of data/information. These four levels are:

1. Organisation
2. Assurance
3. Data Processing
4. Support

The concept of Functional Levels is explained more fully in Section 2.7.

2.4. Data Assurance Levels

2.4.1 Overview

The aim of the DAL approach is to ensure that the data processes employed by a party are adequate to address the specified Data Quality Requirements. As stated previously, there are many different but equally valid approaches to assuring data quality so it is not feasible to construct a specification that is specific enough for every party. The DAL Specification, therefore, uses a layered approach to demonstrate the adequacy of a party's data processes, which is similar, in principle, to that adopted for software safety assurance objectives in software safety standards.

- ADQ IR Annex VII, Part A(2), defines EN ISO 9001 certification as a means of compliance with the provisions regarding a party's Quality Management System (ADQ IR Annex VII, Part A(1)). Thus EN ISO 9001 certification is sufficient in addressing the requirement for a QMS, however, it is recognised that this is a generic standard and it does not include specific requirements in relation to assuring aeronautical data quality or the processes conducted.
- The DAL objectives thus supplement and enhance the baseline QMS requirements by specifying:
    - What the party's QMS and data processes must specifically include or address.
    - The degree of rigour to be employed, e.g. through defining the objectives for specific processes in more detail or enforcing independent review (see section 2.4.4).
    - Other objectives to ensure that the specific processes, including Work Instructions and tools, used by a party are adequately designed, analysed, implemented and documented (see section 2.4.2).

It is assumed that parties involved in aeronautical data provision holding a valid ISO 9001 certificate[2] that their QMS and data process are already compliant with many of the DAL obligations. For those objectives the ISO Certificate should be sufficient evidence of compliance, as long as:

- Parties provide evidence that the "approved applicability" of the certification matches the subject matter of the objectives;
- Subsequent changes to the processes do not affect DAL compliance.

It remains the party's responsibility to ensure that the specific processes employed are adequate in every respect and will continue at all times to produce data of the required quality.

2.4.2 Data Process Assurance Levels and Tool Qualification Levels

A party's overarching process for handling aeronautical data/information and associated products, e.g. reports, components of the IAIP, etc. consists of a collection of individual data processing tasks. Each task can be performed by a human and/or a tool. Most of the failures in a data provision service will be caused by human or Tool errors, omissions or mistakes. These errors can be minimised by ensuring that the right Work Instructions, staff training and Tools are applied.

Some tasks are best performed by humans, some by Tools and some a combination of the two[3]. The degree to which the Work Instruction or Tool is relied upon determines the assurance required that the Work Instruction or Tool is fit for purpose.

A party's overarching process for handling aeronautical data/information and associated products, e.g. reports, components of the IAIP etc. must be defined. The constituents[4] and associated procedures[5] that implement the party's overarching process need to be clearly identified either as those that

- Measure data as part of data origination (**data measurement**).
- Process aeronautical data/information and can credibly introduce data errors (**data processing**).
- Verify and validate aeronautical data/information (**data checking**).
- Are not otherwise covered by the above (**other**).

Furthermore, the independence between the Work Instructions and/or Tools that process the data and the Work Instructions and/or Tools that verify and validate must be demonstrated. As such, analysis of the party's entire data process needs to be conducted to assess the independence between the data processing and data checking elements. The results of the assessment must be used to provide feedback into the implementation of the party's overarching process as appropriate. The assessment of the process also needs to consider automation of Work Instructions in accordance with the requirements and objectives of section 4.4.5.

For the Work Instructions and/or Tools used in either the data processing or data checking (or both) functions, it is necessary to demonstrate that they are fit for purpose,

[2] The ISO 9001:2015 International Standard had been published in September 2015 starting a 3-year transition period. Therefore, certifications to ISO 9001:2008 will no longer be valid after September 2018.

[3] The overall aim is to automate tasks wherever beneficial; Article 6(7) (Annex IV, Part E) of the ADQ IR includes provisions for data process automation (see also section 4.4.5).

[4] EC Reg. No 552/2004 defines constituents as "tangible objects such as hardware and intangible objects such as software upon which the interoperability of EATMN depends". Note that the term 'Tool' is also used in this document to refer to EATMN system constituents.

[5] Associated procedures are, in the context of this DAL Specification, the detailed set of actions that are undertaken relating to a process. In this DAL Specification associated procedures are also referred to as Work Instructions.

and have been developed to provide the required quality. Specifically for tools, a Tool Qualification Process (TQP) is required to provide assurance that the Tool employed will not degrade data quality.

The degree of assurance provided for a Work Instruction or a Tool must be commensurate with the integrity level of the data the Work Instruction or Tool is handling. But it can also be related to the degree of reliance placed on the Work Instruction or Tool for assuring data quality.

Parties may choose to implement Tools and processes solely on the basis of the integrity level of the data or may, where justified further, reduce the assurance requirements where the Tool or Work Instruction is not solely relied upon. For this reason it is necessary to expand the general DAL categorisation to assign a separate Data Processing Assurance Level (DPAL) and Tool Qualification Level (TQL) for each Work Instruction and Tool respectively.

For **data processing Work Instructions or tools**, the DPAL or TQL respectively is determined by the DAL of the data the Work Instruction or Tool is handling, and the degree of reliance on the Work Instruction or Tool to process the aeronautical data and information. The latter is defined as being:

- Sole reliance: the Work Instruction or Tool is relied on to process / generate data without data errors.
- Major reliance: there is at least one independent means of detecting data errors that could be introduced by the Work Instruction or Tool (which may be implemented in one or more primary Tools or Work Instructions).
- Minor reliance: there are two or more independent mechanisms that can detect the data errors that could be introduced by the Work Instruction or Tool (which could be in the form of two or more secondary Work Instructions or tools).

For **data checking Work Instructions or tools,** the DPAL or TQL respectively is similarly determined by the integrity level of the data the Work Instruction or Tool is handling (DAL) and the degree of reliance on the Work Instruction or Tool to detect data errors in the aeronautical data/information or product, where reliance in this context is defined as:

- Primary: the Work Instruction or Tool is the only means of detecting the data errors in the aeronautical data/information or product. Detection of all data errors maybe achieved by one or more Work Instructions or tools.
- Secondary: the Work Instruction or Tool is used to support the detection of data errors but other independent means exist that are used to check for the same data errors, including other Work Instructions or tools.

NOTE: *DPAL and TQL assignments can be set to match practical limitations in the assurance of specific Tools or Work Instructions, for example additional checks can be introduced to detect and protect against known deficiencies in a software tool[6], thus avoiding the need to assign high TQLs which are not demonstrable*.

The concepts of DPALs and TQLs are used in the objectives for the definition, design, validation, transfer into operation and operation of Work Instructions (including Work Instruction templates) (see sections 4.1.4.2.2 to 4.1.4.2.6) and Tools (including templates) (see section 4.6.4.1 as an indicator for the assurance activities required at each level.

[6] e.g.If a commercially available database was used to store survey points the corresponding CRC value could be checked by a separate Tool before use to assure that the survey point data had not been corrupted by the tool.

2.4.3 Application

The DALs are allocated at all Functional Levels contributing to the realisation of the requisite data quality. The ADQ IR provisions are satisfied by objectives, provided mainly from extant material. The stated objectives in most cases correspond to requirements defined in the extant material.

The DAL Specification addresses the evidence requirements for data quality in Annex IV, Part B, either directly or indirectly in relation to other provisions in the ADQ IR (this relationship is described further in section 3.1). The DAL Specification defines:

a. All objectives required to address Article 6(2).

b. Further objectives to assure data quality in relation to other provisions in the ADQ IR.

c. The applicability of the objectives to each DAL.

These objectives not only span the individual processing stages for the data, but also all the Functional Levels contributing to the overall quality of the resulting data.

2.4.4 Independence

For the assurance of data quality at DAL 1 and DAL 2 it is good practice to have multiple layers of defence to prevent data errors being introduced or missed during the data processing or checking activities. This not only applies to the Work Instructions and Tools used directly in the processing of data but also the support processes used, for example, in the development and maintenance of those Tools and Work Instructions. To assure the effectiveness of these defences it is necessary to demonstrate that they are sufficiently robust and independent. The robustness is addressed through the assignment of DPALs or TQLs (see section 4.1.4.2). However, the method used to assure independence depends on how the defences are implemented. As such the DAL Specification addresses independence in two different ways:

1. By defining the degree of managerial independence required in the implementation of certain objectives, as shown in the DAL columns for each table of objectives.

2. Defining specific objectives for independence or the assurance of independence, especially in relation to the way in which procedures and Tools are designed and implemented; e.g. as discussed and addressed in the objectives of section 4.1.4.2.

The degree of independence required in the implementation of objectives is determined primarily by the assigned DAL. So, for objectives at DAL 1 and DAL 2, a greater degree of independence is required than for objectives at DAL 3. The independence is required between the person, department or organisation performing[7] the primary activity, and the person, department or organisation verifying or validating the activity output. The manner in which independence is implemented will also depend on the specific objective being satisfied and the extent of automation.

In the objectives' tables the independence requirement for an objective is identified as '●'. The degree of independence required for this objective is then indicated as follows:

- Peer (P) - another suitably qualified and experienced person within the same group or department must satisfy the objective.
- Independent Department (D) - a suitably qualified and experienced person within a separate group or department must satisfy the objective.

[7] Even if the process is partially or fully automated a person is still responsible for the implementation of the objective as defined within the relevant Work Instruction e.g. making sure the Tool is used at the correct time and the output of the Tool is used correctly.

The separation of duties is a common means of satisfying the internal independence requirement.

2.5. Aeronautical Data Chain

2.5.1 Overview

The Aeronautical Data Chain is a conceptual representation of the stages for aeronautical data and information production from its origination through to end use. The Aeronautical Data Chain has a number of defined stages from data request for origination to operational use (end user).

The Aeronautical Data Chain comprises the following stages as shown in Figure 4:

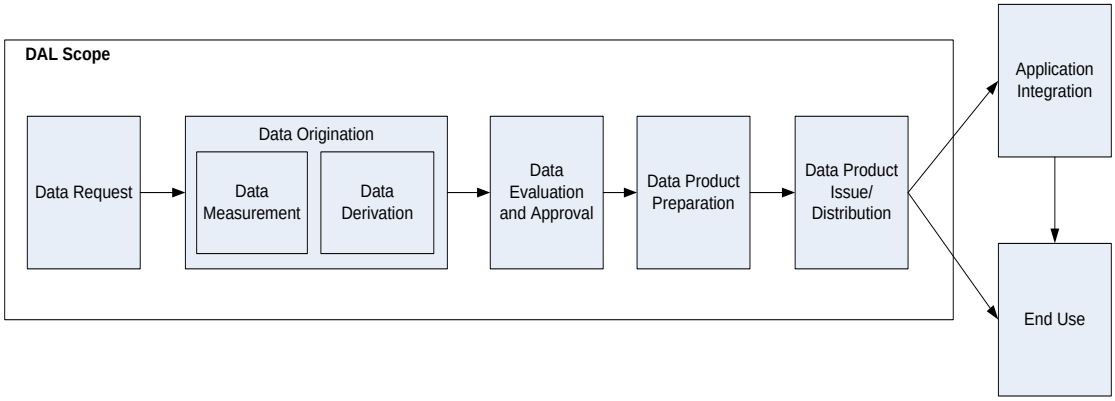

Figure 4: Aeronautical Data Chain

The Aeronautical Data Chain is, in practice, far more complex in nature, as it involves a substantial number of organisations. However, the fundamental data lifecycle stages are followed in sequence as shown in Figure 4.

Some types of data and information do not strictly obey this convention. In addition, interfaces also exist supporting a variety of related communications:

a) Requesting information, queries and clarifications.

b) Formal Arrangements.

c) Data Product Specification.

d) User Requirements.

e) Error reporting and resolution.

2.5.1.1 Aeronautical Data Chain Stages

A brief description of each stage is provided below:

Data Chain Stage	Outline Description
Data Request	The Data Request stage is concerned with the activities involved in requesting data origination. This stage is perceived as the most critical as the quality of data produced at this stage significantly influences the overall data quality used for operations, both in terms of working with what is provided and making corrections in later data chain stages.

Data Chain Stage	Outline Description
Data Origination	The Data Origination stage is concerned with the collection of source data, and generation of derived data. Values, names or other information are determined and assigned to data elements required for use in a subsequent stage. Part of the data origination activities is concerned with the measurement of data; in Figure 4 this is captured as a distinct box named 'Data Measurement' to distinguish the measurement from all other data origination activities that are concerned with the calculation and/or derivation of data from other data. The latter is captured by a different box called 'Data Derivation'. Data Origination includes activities such as Procedure Design and surveying. The data origination activities are controlled between the originating and requesting authority, the responsibility allocated to Member States.
Data Evaluation and Approval	The Data Evaluation and Approval activity receives data from Data Origination and conducts the process of assessing, evaluating, and approving the data in preparation for storage, further processing, and publication.
Data Product Preparation	The Data Product Preparation activity receives approved data from Data Evaluation and Approval, stores it in the Register, assesses how it is going to be published and involves a number of steps in preparing the information for publication. **NOTE**: *After the approved data has been stored in the Register, it becomes known as Information. The product preparation activity mainly consists of activities carried out on approved data and activities carried out after the approved data becomes information.*
Data Product Issue / Distribution	The Data Product Issue / Distribution activity provides the necessary printing, publishing, and distribution of aeronautical information in both electronic and hard copy form to the next intended user.
Application Integration	This stage is concerned with the preparation and integration of information into operational systems.
End Use	This stage is where operational and other use e.g. End-User manual production, is made of the data and information.

2.6. Data Error Barriers

The Data Error Barrier concept has been developed for the DAL Specification, based on a similar concept used for ATM safety assessment activities, known as the ATM Barrier Model. The ATM Barrier Model is useful in describing various means of mitigation applied, in achieving target levels of safety for aircraft and air traffic operations. However, the ATM system can also introduce errors at or between the barriers.

The barriers applied to the Aeronautical Data Chain are present within each stage of the aeronautical data chain as represented in Figure 5:

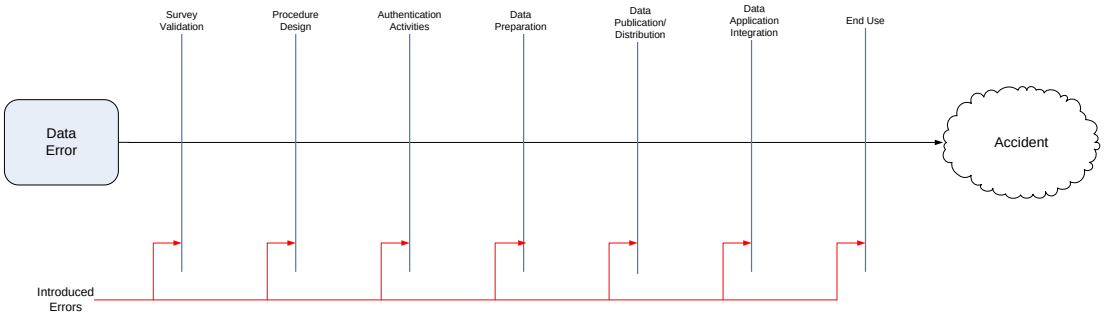

Figure 5: Data Error Barrier Model

The barriers explicitly or implicitly employed will detect and mitigate one or more types of data error. The data process can also introduce errors at or between the barriers, wherever the data is edited, transformed or otherwise modified. The DAL objectives associated with each barrier are thus aimed at minimising operational service failures arising as a result of aeronautical data and information errors introduced either at source or as part of the data preparation process.

- **Errors at Source** - The sequence of data barriers in the Aeronautical Data Chain presents the path of a data error introduced from an origination source. If the data error is not detected at any barrier in the Aeronautical Data Chain the consequence may be an incident or accident.
- **Introduced Errors -** Activities conducted at each stage can also introduce data errors that can be propagated through the Aeronautical Data Chain into the operational environment. At each barrier not only is it important to ensure that data errors are minimised within the data processing activities, but also at other Functional Levels within a party/supplier involved in the data chain activity see section 2.7.

Factors such as the assigned DAL, the degree of data processing and the path taken by each data item influences the rigour of requirements that should be set for each barrier in assuring the overall data quality output.

The types of aeronautical data/information and products to be considered include:

a) Survey data

b) Design data

c) Derived data

d) Procedure design

e) Charts, including airport and obstacle

f) NOTAM

g) Other data, pertaining to terrain / geographical data sourced

2.7. Functional Levels

2.7.1 Overview

The Functional Levels are defined on the premise that operating processes and procedures alone for data processing will not solely determine the quality of data produced. The collective capabilities and facilities of a party will also influence the overall consistency of data quality.

Each party participating in the Aeronautical Data Chain may form part or a whole of a business. The four Functional Levels defined correspond to the essential business

infrastructure elements required to discharge party obligations in the production of aeronautical data and information.

The four Functional Levels defined for a business to operate are presented in Figure 6:

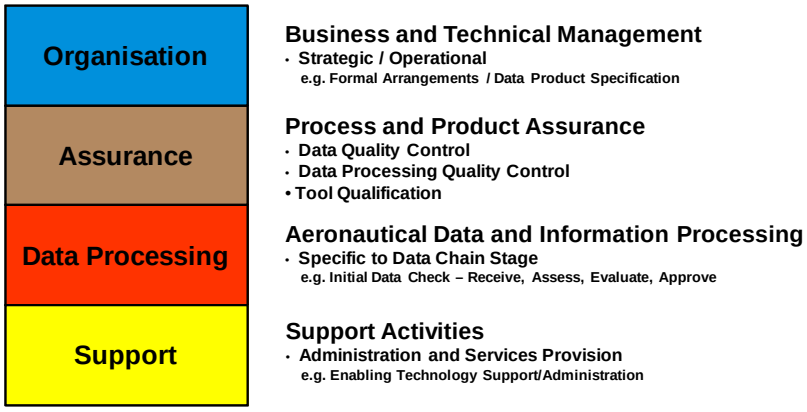

Figure 6: Functional Levels

2.7.2 Level Descriptions

The outline scope and demarcation of each level is described below:

Functional Level	Description
Organisation	The Organisation aspects relate to management / supervisory functions conducted to provide strategic guidance in addition to operational supervision for assurance, data processing, and support activities. This functional level encompasses both the business, technical and operational management supporting the scope of aeronautical data and information activity.
Assurance	The Assurance aspects include activities directed at quality assurance and control of the data processing activities. Assurance includes also conducting safety and security assurance activities.
Data Processing	The Data Processing aspects cover the operational procedures and activities in processing, storage and communicating of aeronautical data and information.
Support	The Support aspect provides facilities and administration including IT infrastructure and support for aeronautical data and information processing and other business related activities.

2.7.3 Guidance

The ADQ IR defines provisions for all of the Functional Levels. The demarcation of activities between each functional level is determined by individual parties. There are a number of influences dictating the level at which compliance to the provision is achieved. A generic business structure is defined in ANNEX H FUNCTIONAL LEVELS. This is for illustrative purposes only, but serves to inform all parties of where a logical boundary exists between each functional level.

3 OBJECTIVES AND REQUIREMENTS OVERVIEW

3.1. Introduction

This section presents the key objectives and structure used for defining the detailed DAL objectives. The DAL objectives are organised into functional areas as defined in section 3.4. The objectives for the functional areas apply to one or more of the Aeronautical data chain stages as depicted in section 3.5.

The DAL objectives are defined in sections 4 and 5 and cover all ADQ IR provisions in scope of the DAL Specification as discussed in sections 1.2 and 1.3. These sections correspond to the order of the chapters in the ADQ IR except for Article 6(2) (Evidence Requirements) which is presented first as it is the primary focus of the DAL Specification.

3.2. Key Objectives

The main mission in the provision of aeronautical data / information is to originate, process and supply data / information that satisfy the applicable data quality requirements thus contributing to the overall safety of aircraft and air traffic operations.

The key objectives addressed by the ADQ IR are:

a) The provision of aeronautical data with the required quality.

b) The timely provision of aeronautical information.

c) The continued provision of aeronautical data in circumstances where the ‘chain’ or part of it is subject to degraded operation (contingency planning).

d) A generic (unified) aeronautical data process supporting a unified approach to meeting the data needs of existing and future applications.

3.3. Structure

For each group of provisions e.g. data protection, defined in the ADQ IR the DAL objectives are presented in the following structure:

Overview	Presents an outline of the scope and content that the objectives cover in relation to the ADQ IR provisions.
Provisions	Defines the provisions extracted from the ADQ IR.
Application	Provides guidance to the party/supplier on the scope that the provision and objectives cover in terms Aeronautical Data Chain stages, Functional Levels, and Data Assurance Level considerations.
Objectives	This section defines the DAL objectives relevant to the respective ADQ IR provision.

3.4. Objectives Characterisation

Every objective in this Specification is identified using the following reference system:

DAL-[Fn]-[nnn]

Where

- **DAL** represents Data Assurance Level;

- **[Fn]** defines the functional area; the table below presents a list of all functional areas.
- **[nnn]** is a numeric identifier for each [Fn] category.

Abbreviation	Functional Area	DAL Specification Section(s)
DAL-AR	Additional Requirements	5.3.4
DAL-CM	Security Management	4.8.3.4
DAL-CT	Consistency, Timeliness	4.5.4.1, 4.5.4.2, 4.5.4.3
DAL-DE	Data Exchange	4.3.4
DAL-DP	Data Protection	4.7.4.2, 4.7.4.3, 4.7.4.4
DAL-DS	Data Set	4.2.4
DAL-DTP	Data Transmission Protection	4.7.4.1
DAL-ER	Error Reporting	4.4.6.3, 4.4.6.4
DAL-EV	Evidence	4.1.4.1
DAL-FA	Formal Arrangements	4.4.3.3
DAL-PRC	Processes	4.1.4.2.1, 4.1.4.2.2, 4.1.4.2.3, 4.1.4.2.4, 4.1.4.2.5, 4.1.4.2.6
DAL-QM	Quality Management	4.8.1.4
DAL-RDO	Request for Data Origination	4.4.4.3.1
DAL-SM	Safety Management	4.8.2.4
DAL-STC	Staff Training and Competency	4.5.4.4
DAL-TS	Tools and Software	4.6.4

3.5. Applicability of Objectives

The DAL objectives applicable to each stage in the Aeronautical Data Chain, as described in section 2.5, are illustrated in Figure 7 below. If a party is involved in an Aeronautical Data Chain stage, for example a data originator, then the objectives applicable to them are as captured for the origination stage and its interfaces with other stages.

For each stage, there may be objectives that are relevant:

- only to that stage;

- to that stage as well as to a number of other stages;
- to all stages.

The figure captures the applicability of objectives as follows:

a. Objectives that are applicable only to specific Aeronautical Data Chain stages (highlighted in yellow). For example, DAL-RDO objectives are only applicable to Data Origination stage. Therefore, if a party is a data originator, then these objectives apply specifically to them.

b. Objectives that are applicable to most Aeronautical Data Chain stages (highlighted in blue). For example, DAL-DS objectives are applicable to all stages except at the exchange points between any two stages.

c. Objectives that are applicable to all Aeronautical Data Chain stages (highlighted in green). For example, DAL-STC objectives on staff training and competency are required for all stages in the Aeronautical Data Chain.

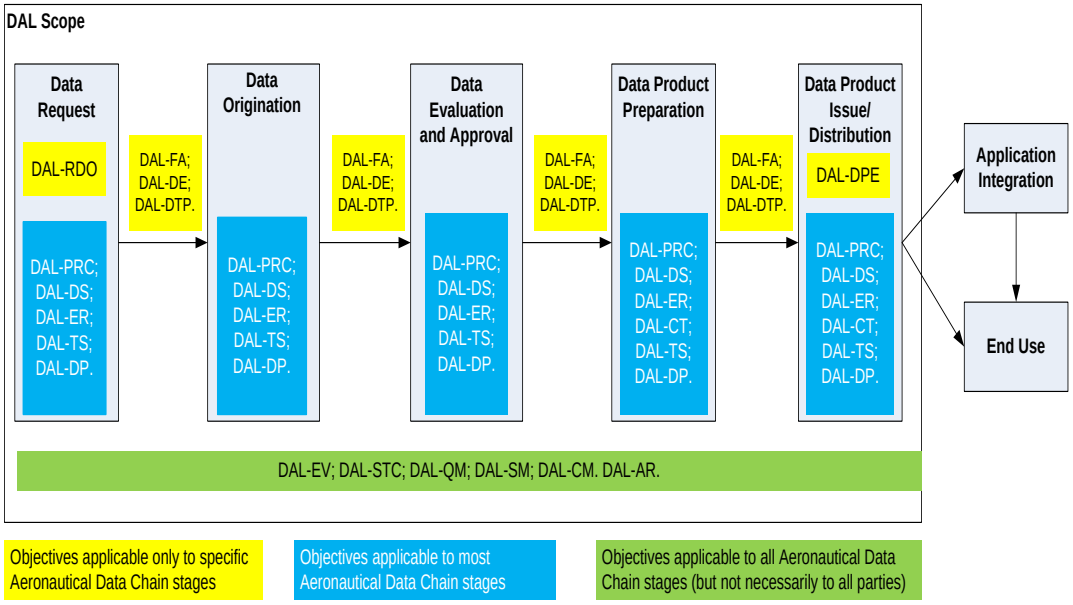

Figure 7: Applicability of DAL Objectives to Aeronautical Data Chain Stages[8]

[8] Note that DAL-AR objectives are not applicable to all parties, see section 5.3.1 for details.

4 INTEROPERABILITY AND PERFORMANCE REQUIREMENTS

4.1. Evidence Requirements

4.1.1 Overview

The requirements of Article 6(2) are presented in a table showing how they are addressed by the DAL Specification in relation to the other ADQ IR provisions and the associated objectives required for evidence.

4.1.2 Provisions

The provisions for evidence requirements are defined in the ADQ IR, Article 6(2) and Annex IV, Part B

4.1.3 Application

The following table captures how the requirements of Annex IV, Part B (referred to by Article 6(2)) are captured in the rest of the ADQ IR Provisions and within the DAL Specification ADQ IR sections. It should be noted that Means of Compliance may be identified for the other articles, which should be read in conjunction to the DAL Specification.

Annex IV, Part B Ref	Annex IV, Part B Requirement Text	DAL Specification Section – ADQ IR Article
(a)	Accuracy and resolution requirements are achieved at data origination and maintained through to publication to the next intended user, including, whenever the resolution of a data item is reduced or changed, or the data is translated into a different co-ordinate system or unit of measurement.	Addressed by the objectives in: • Section 4.2 - Article 4 (Annex I) • Section 4.3 - Article 5 (Annex II) • Section 4.4.4 - Article 6 (Annex IV, Part D) • Section 4.7 - Article 9 (Annex VI).
(b)	The origin and change history for each data item is recorded and available for audit.	Addressed by the objectives in Section 4.2 - Article 4 (Annex I, Part C).
(c)	The data or information is complete or any missing items are declared.	Addressed by the objectives in: • Section 4.2 - Article 4 (Annex I) • Section 4.5 - Article 7.

Annex IV, Part B Ref	Annex IV, Part B Requirement Text	DAL Specification Section – ADQ IR Article
(d)	All data origination, production, storage, handling, processing, transfer or distribution processes used for each data item are defined and adequate for the assigned level of integrity of the data item.	Adequacy objectives for all data processes are defined in the tables in section 4.1.4.2. For data origination by the objectives in: • Sections 4.4.4, 4.4.5 and 4.4.6 - Article 6 (Annex IV Part D[9], Part E, and Part F) For data production, handling and processing by the objectives in • Section 4.2 - Article 4 (Annex I) • Section 4.5 - Article 7 For data storage, transfer and distribution processes by the objectives in • Section 4.3 - Article 5 • Sections 4.4.5 and 4.4.6 - Article 6 (Annex IV Part E, Part F) • Section 4.5 - Article 7 • Section 4.7 - Article 9
(e)	Data validation and verification processes are adequate for the assigned integrity level of the data item.	Adequacy objectives for all data processes are defined in the tables in section 4.1.4.2).
(f)	Manual or semi-automated data processes are performed by trained and qualified staff, with clearly defined roles and responsibilities that are recorded in the party's quality system.	Addressed by the objectives in: Sections 4.4.5 and 4.5 - Article 7(4) and Article 7(5) Section 4.8 - Article 10 (Annex VII Part A).
(g)	All Tools and/or software used to support or implement the processes are validated as fit for purpose in accordance with Annex V [refer to Section 4.6 on Tools and Software Requirements in this DAL Specification].	Addressed by the objectives in Section 4.6 - Article 8 (Annex V).
(h)	An effective error reporting, measurement and corrective action process is in operation in accordance with Part F.	Addressed by the objectives in Section 4.4.6 - Article 6 (Annex IV, Part F).

[9] Data origination requirements are specified in the DO Specification and only objectives related to data quality are include in the DAL Specification.

Achievement of the above provisions requires suitable arguments and evidence to demonstrate compliance in the context of a compliant and active Quality Management System (QMS). It is important that not only is compliance demonstrated initially but also continues to be demonstrated as part of ongoing activities.

4.1.4 Objectives

A number of objectives have been developed relating to the types and adequacy of evidence required. These objectives are captured in the following tables.

4.1.4.1 Types of Evidence Required

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-EV-020	The party's overarching process of handling aeronautical data and associated products shall ensure that the data is: • provided according to a data set specification compliant with the requirements of Annex I of the ADQ IR; • complete in relation to the defined data set; • traceable in that the origin of the data and the changes made to the data are recorded; • handled in accordance with relevant standards.	O	O	O	
DAL-EV-030	The party's overarching process of handling aeronautical data and associated products shall ensure that the aeronautical information products: • comply with a standard product specification; • completely and correctly reflect the input data used; • are provided in a timely manner, i.e. in accordance with the most current update cycles; • comply with any other relevant standards.	O	O	O	
DAL-EV-070	In service records shall be maintained for each constituent[10] of the EATMN system[11] including as a minimum the items from ANNEX I.2 of this DAL specification.	O	O	O	
DAL-EV-080	Parties shall provide evidence that their ISO 9001 Certification complies with the provisions of ADQ, Annex VII.	O	O	O	

4.1.4.2 Adequacy of Data Processes

[10] EC Reg. No 552/2004 defines constituents as “tangible objects such as hardware and intangible objects such as software upon which the interoperability of EATMN depends”. Note that the term ‘Tool’ is also used in this document to refer to constituents.

[11] Annex I of EC Reg. No 552/2004 subdivides EATMN into eight systems. In the context of the DAL Specification, EATMN system refers to Annex I, item 7 *Systems and procedures for aeronautical information services*.

This section covers the objectives for a party's data processes and its implementation by constituents and associated procedures[12]. The objectives of this section also cover the process of Data Origination except for the calibration of measurement tools, objectives for which are defined in the DO Specification.

The applicability of these objectives, for existing data processing and data checking Work Instructions and any minor changes to them or for new or upgraded[13] Work Instructions, is captured in the following table:

	Applicable Sections
New or Upgraded Work Instructions	4.1.4.2.1; 4.1.4.2.2; 4.1.4.2.3; 4.1.4.2.4; 4.1.4.2.5; 4.1.4.2.6.
Existing Work Instructions	4.1.4.2.1; 4.1.4.2.6.

4.1.4.2.1 General (overarching data process)

Objective Reference	**Objective**	**DAL 1**	**DAL 2**	**DAL 3**	**Remarks**
DAL-PRC-010	Work Instructions giving the details of the set of actions that are undertaken relating to each process shall be defined including as a minimum the items from ANNEX I.3 of this DAL Specification.	O	O	O	
DAL-PRC-020	The Work Instructions that implement a party's overarching process of handling aeronautical data and associated products shall be clearly classified and documented as either: • measurement (origination) Work Instructions; • data processing Work Instructions; • data checking Work Instructions; • other Work Instructions.	O	O	O	

[12] Associated procedure is, in the context of this DAL Specification, the detailed set of actions that are undertaken relating to a process. In this DAL Specification associated procedures are also referred to as Work Instructions.

[13] Article 2(40) of Regulation (EC) No 549/2004 defines an upgrade as *"any modification that changes the operational characteristics of a system"*. To determine whether or not a system has been 'upgraded' requires the air navigation service provider to establish whether or not the operational characteristics of the system have changed. A process for determining changes to a system's operational characteristics along with the subsequent impact of those changes is described in the EUROCONTROL Guidelines on Conformity Assessment.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-PRC-030	The classification of Work Instructions shall be validated according to DAL-PRC-020.	● D	● D	○	
DAL-PRC-050	For data processing Work Instructions, parties shall assign a Data Processing Assurance Level (DPAL) based on the most stringent DAL of the data the Work Instruction is handling. The DPAL assigned shall be justified with overall safety considerations and, if required, the degree of reliance on the Work Instruction as follows: **Reliance** **DAL** **Sole** **Major** **Minor** **DAL 1** DPAL 1 DPAL 2 DPAL 3 **DAL 2** DPAL 2 DPAL 2 DPAL 3 **DAL 3** DPAL 3 DPAL 3 DPAL 3.	○	○	○	
DAL-PRC-060	For data checking Work Instructions, parties shall assign a Data Processing Assurance Level (DPAL) based on the most stringent DAL of the data the Work Instruction is handling. The DPAL assigned shall be justified with overall safety considerations and, if required, the degree of reliance on the Work Instruction as follows: **Reliance** **DAL** **Primary** **Secondary** **DAL 1** DPAL 2 DPAL 2 **DAL 2** DPAL 2 DPAL 3 **DAL 3** DPAL 3 DPAL 3.	○	○	○	
DAL-PRC-070	If a Work Instruction is classified as both a data processing and data checking Work Instruction, the most stringent DPAL, as defined by objectives DAL-PRC-050 and DAL-PRC-060, shall apply.	○	○	○	
DAL-PRC-080	The assignment of a DPAL to data processing or data checking Work Instructions shall be verified against the requirements from DAL-PRC-050 or DAL-PRC-060.	● D	● D	○	

4.1.4.2.2 Work Instructions Requirements

Objective Reference	Objective	DPAL 1	DPAL 2	DPAL 3	Remarks
DAL-PRC-160	Representatives of all relevant stakeholder groups, internal and external to the party, should be represented in the definition, review and acceptance of the Work Instructions.	○	○	○	
DAL-PRC-170	Relevant published material should be used as input in the definition phase of a Work Instruction including lessons learnt and relevant metrics with parties that have successfully implemented a similar Work Instruction.	○	○	○	

Objective Reference	Objective	DPAL 1	DPAL 2	DPAL 3	Remarks
DAL-PRC-180	The Work Instructions shall be validated.	● D	● D	○	
DAL-PRC-190	The party's overarching process for handling aeronautical data/information and associated products shall be assessed to ensure that all the applicable Work Instructions are defined.	● D	● D	○	

4.1.4.2.3 Work Instructions Validation

Objective Reference	Objective	DPAL 1	DPAL 2	DPAL 3	Remarks
DAL-PRC-200	Data checking and data processing Work Instructions shall be validated prior to use as not contributing to data errors in the aeronautical information or product.	● D	● D	○	
DAL-PRC-210	Data checking Work Instructions shall be analysed prior to use to identify how the Work Instruction can fail to detect data errors.	● D	● D	○	
DAL-PRC-220	Work Instructions involving transformations from one format to another shall be validated prior to use to ensure that anomalies and ambiguities that can arise from this transformation are identified and addressed.	● P	○	○	
DAL-PRC-230	Work Instructions shall be validated through relevant stakeholder group review.	○	○	○	
DAL-PRC-240	Work Instructions shall be validated prior to use by performing pre-implementation trials where practicable.	● D	● D		

4.1.4.2.4 Work Instructions Implementation

Objective Reference	Objective	DPAL 1	DPAL 2	DPAL 3	Remarks
DAL PRC-260	Work Instructions shall be approved at the Organisation Functional Level prior to use.	○	○	○	

4.1.4.2.5 Work Instructions Transfer into Operation

For parties holding a valid ISO 9001 Certificate it is assumed that this sub-chapter is adequately covered by the ISO QMS in place.

4.1.4.2.6 Work Instructions in Operation

For parties holding a valid ISO 9001 Certificate it is assumed that this sub-chapter is adequately covered by the ISO QMS in place.

4.2. Data set (Article 4)

4.2.1 Overview

The purpose of the ADQ IR is to provide a unified approach to the definition of data sets used for IAIP, aerodrome mapping, electronic obstacle data, and electronic terrain data. A component of this definition is the content of metadata that is needed to identify such elements as the data originator, change history and details of verification and validation performed.

4.2.2 Provisions

The provisions for data set requirements are defined in Article 4 and Annex I of the ADQ IR.

4.2.3 Application

There are three elements to data set provision:

1. A common data set definition for IAIP, aerodrome mapping and electronic obstacle data.
2. The provision of 'digital' electronic terrain data sets in compliance to ICAO Annex 15.
3. Metadata requirements that support both of the data sets above.

The data set definition for IAIP, aerodrome mapping and electronic obstacle data requires to be documented in one of two forms. This is either as an UML (Unified Modelling Language) model or as a feature catalogue based on the standard ISO 19110:2005. The models need to include the data elements for publication specified in ICAO Annex 15 and the current version of EUROCAE ED-99. The models also need to include the attributes defined in the ADQ IR provision together with the metadata requirements.

The development of the models should be undertaken at an international level. The aim of this is to achieve unified models to be used by Member States as the basis of ongoing system development in compliance with the ADQ IR. The models should be accompanied by the requirements, rules, and guidance that can be promulgated to all parties in the Aeronautical Data Chain. The models and these elements will provide the basis for the progressive process automation of the Aeronautical Data Chain. Member States technical authorities are tasked with providing advice and assistance to parties complying with the models.

The provision of the electronic terrain data set in digital form is a requirement made in accordance to ICAO Annex 15 combined with the need to maintain metadata on each element of the data set. Member States and parties involved in the provision of these electronic terrain data sets are required to develop systems and processes to deliver this facility.

4.2.4 Objectives

The objectives for the data sets relating to the provision of data quality are presented below:

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DS-010	The implementation of the data set relevant to the party shall be verified against the data set specifications defined in Annex I of the ADQ IR.	● D	● D	O	

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DS-020	The applied version of the data set specification and rules shall be agreed as part of the Formal Arrangements.	O	O	O	

4.3. Data Exchange (Article 5)

4.3.1 Overview

The Aeronautical Data Chain involves many organisations and stakeholder groups that routinely transmit data between them and the next intended user. The data exchange formats defined by the ADQ IR are designed to meet existing and future needs within the industry.

The ADQ IR defines the data exchange formats that are to be followed:

- For IAIP, Aerodrome Mapping, and Electronic Obstacle Data – XML (eXtensible Mark-up Language) and its associated supported features e.g. schematron, are to be implemented, along with GML (Geography Markup Language) presenting geographic information.
- For Electronic/Digital Terrain Data – GML defining spatial schema, metadata, and encoding in compliance with a number of ISO 19100 standards.

4.3.2 Provisions

The provisions for data exchange are defined in Article 5 and Annex II of the ADQ IR.

4.3.3 Application

4.3.3.1 Overview

The data exchange requirements are relevant to all stages of the Aeronautical Data Chain within scope. However, only the direct electronic connection requirements are applicable to all parties and the data exchange format requirements do not currently apply to the data origination stage, notably data surveyors and externally sourced geographic/terrain data.

> **NOTE:** *It is considered essential that the ANSPs use a common exchange format between themselves that can be met by a common specification. However, for non-ANSP data originators, significant improvements in data quality and interoperability could still be achieved by allowing them to exchange data digitally in a common format as long as all parties use a common data set.*

The implementation and operation of these objectives affects all Functional Levels.

4.3.3.2 Organisation

At the organisational level the emphasis is managing the technical aspects of the data exchange format requirements. The activities conducted at this level by a designated technical lead (technical authority) should include the following:

1. Technical definition/specification and service provision of the data transfer format protocols (this may be used as input of the safety assessment if applicable).
2. Review and evaluation of any changes to directives of use or to the standards on which the data exchange provisions are defined.
3. Technical definition, planning, implementation and maintenance of tools, software, and facilities supporting data exchange processing.
4. Development and maintenance of production processes.
5. Staff briefing, training, monitoring, performance assessment etc.

4.3.3.3 Assurance

Assurance activities are directed at reviews and audits of the technical aspects of the data exchange provisions. They include:

1. Quality and security review/audit of data/information transfer facilities.
2. Technical quality review of compliance with the objectives, both definition and implementation.
3. Technical reviews and audits of the production processes.
4. Participation in the quality checking and control of data formatting.

4.3.3.4 Data Processing

The data processing aspects follow the prescribed production processes for the formatting of data/information for transfer between ANSPs.

Parties involved in the production of AIPs, AIP amendments, and AIP supplements need to ensure that the production of the AIP elements are conducted by data processing staff to defined specifications and processes.

4.3.3.5 Support

The support aspects cover the administration of the tools, software, and facilities used for data exchange processing. The administration activities include implementation, operational support, routine maintenance and application of facility changes or enhancements.

4.3.4 Objectives

4.3.4.1 Direct Electronic Connection

The guidance material for data transmission is covered in CHAIN/0029, Section 3.4.

Further guidance material for mechanisms to ensure the protection of the integrity is covered in the ADQ Guide.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DE-030	The application of mechanisms to ensure the protection of the integrity of the data as required in Article 9(1) and Annex VI(1)(2) shall be validated.	● D	● P	○	
DAL-DE-040	On receipt of data, it shall be verified that the source data is from an authorised source[14].	○	○	○	
DAL-DE-050	Data changes received from unauthorised sources shall be verified with the authorised source of that data before being processed further.	○	○	○	
DAL-DE-060	Data that cannot be verified with the authorised source shall not be used.	○	○	○	
DAL-DE-070	Documentation shall be maintained that identifies all the data item suppliers used by the party and the approval status of the data item.	○	○	○	
DAL-DE-080	After receiving data but before use, data reasonableness checks[15] shall be performed.	○	○	○	

[14] An authorised source can be defined as an entity that is authorised by a legal authority to develop or manage data for a specific business purpose.

[15] For some particular data items of a given data set it is essential to perform reasonableness checks to ensure that the values received for those data items fall within a “reasonable” range. e.g. frequencies, hours of operation…

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DE-090	The data supplier shall be informed in a timely manner of any error discovered during the data reasonableness checks.	O	O	O	
DAL-DE-100	For data received by means other than electronic and/or where manual entry of data is required, the entered data shall be independently verified according to the DIL of the data.	● P	● P	● P	

4.3.4.2 Data Exchange Formats

The DAL objectives presented below are generic, and based on those specified in CHAIN/0029.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DE-110	Whenever aeronautical data/information is exchanged between two parties the data exchange format standard and mechanism which are to be used shall be documented in the Formal Arrangements.	O	O	O	
DAL-DE-120	The implementation of the data exchange standard format and mechanism shall be validated.	● D	● P	O	

4.3.4.3 Data Quality Evaluation on Receipt of Data

Whenever data is transferred between organisations a party reasonableness checks are performed to ensure that the data/ information provided is of the requisite quality. It is recognised that it is not always possible for a party to check every data item in every respect. This is taken into account in the following objectives.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DE-130	Verification procedures[16] shall be developed to evaluate the quality of the data.	O	O	O	
DAL-DE-140	Verification procedures shall be validated to ensure that they commensurate with the data integrity level associated with the data item under verification and that there is a high probability that non-conformances are detected.	● D	● P	O	
DAL-DE-180	The positional accuracy of features assigned a critical data integrity level shall be evaluated by direct means[17], independent of the data origination.	O			

[16] For guidance refer to the EUROCAE ED-76A, Appendix C.2.

[17] Direct methods determine data quality through the comparison of the data with internal and/or external reference information (see also ISO 19114).

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DE-190	Where the positional accuracy of features assigned a critical data integrity level cannot be evaluated by direct means and is estimated by indirect means, the guidance provided by JCGM 100:2008 should be followed.	O			

4.4. Data Quality Aspects (Article 6)

4.4.1 Overview

The data quality provisions made in the ADQ IR (Article 6) cover a number of different aspects of data quality. These provisions are mandated on Member States and parties involved in the processing of aeronautical data and information.

The data quality definition requirements (Article 6(1)) are not within the scope of the DAL specification. These requirements are covered by the EUROCONTROL Specification for Data Quality Requirements (DQR Specification).

The evidence requirements in Article 6(2) are discussed in section 4.1 above.

This section discusses the rest of the data quality aspects addressed by Article 6, i.e.:

- Formal arrangements - Article 6(3)
- Request for Data Origination - Article 6(6)
- Data process requirements - Article 6(7)
- Error Reporting and rectification - Article 6(8).
- Data origination - Articles 6(4) and 6(5), are primarily addressed by the DO Specification

In the remaining parts of this section these provisions are presented together while each data quality aspect is contained in separate sections. This has been done to aid the reader in identifying the distinct parts of the overall data quality provision.

4.4.2 Provisions

The provisions for data quality aspects relevant to the scope of DAL Specification are defined in Articles 6(3) to 6(8) and in Annex IV, Part C to Annex IV, Part F of the ADQ IR.

4.4.3 Formal Arrangements

4.4.3.1 Overview

All parties within the scope of the ADQ IR that exchange aeronautical data and information shall establish a formal arrangement covering the transaction. The ADQ IR provision, Article 6(3) (Annex IV, Part C), stipulates a minimum content of requirements constituting the establishment of formal arrangements between parties.

4.4.3.2 Application

The nature of Formal Arrangements depends on a number of factors. These include the relationship between the parties in terms of the amount, frequency and longevity of the supply of data items, and characteristics and content of the data/information.

The provision for Formal Arrangements between parties is limited to those in scope of the ADQ IR – refer to Section 1.5.2 in this DAL Specification. However, in practical terms these provisions can be applied to other stakeholders that contribute to the acquisition of data that are outside the scope of the ADQ IR.

There are a number of variations that can be applied to the Formal Arrangements. For frequent and consistent data content exchanges between parties, a Formal Arrangement containing all necessary commercial and technical data requirements can be documented. This document should include, for all data items, the quality requirements and the means of ensuring that the requisite level of data integrity is attained. This type of formal arrangement can be reviewed and re-negotiated periodically e.g. annually.

A recommended approach to establish formal arrangements is to agree a Service Level Agreement (SLA) between parties. Comprehensive guidance on setting up and managing SLA's is provided in CHAIN/0056 – Service Level Agreement – Guidance.

In circumstances where the data items change for each individual requirement then a framework agreement can be established that includes the general commercial and technical data requirements. The framework agreement can be based on the general content of a SLA. For each specific data requirement a Data Product Specification is produced and presented from the requestor to the supplier. The Data Product Specification references the general terms and conditions of the framework agreement and specifies the data item requirements that includes all necessary quality attributes and processing to be applied, e.g. validation/verification activities.

In cases where the need for data from a supplier is infrequent or ad-hoc then a Data Product Specification can be used that contains all necessary commercial and technical requirements needed to acquire the specified data items from the supplier.

Irrespective of the type of Formal Arrangement used for the exchange of data items and associated supporting information the Organisation Functional Level is responsible for managing the Formal Arrangements between all parties engaged in the exchange of aeronautical data and information. The definition of the technical attributes and processes applied to the data items should be developed in conjunction with the assurance and data processing, and possibly support, levels.

The minimum content of the Formal Arrangements between parties is defined in ADQ IR, Annex IV, Part C.

Parties participating in data origination or using organisations for origination need to include in the formal arrangements the requirements defined in the provisions.

The scope of Formal Arrangements is not confined to external interfaces with other parties. They are recommended to be established between identifiable groups within an organisation. Formal arrangements made between internal groups assist in managing the processes, Work Instructions and data products. This leads to control that assists the quality and timeliness of the service being provided.

4.4.3.3 Objectives

The DAL objectives for the formal arrangements relating to the provision of aeronautical data/information are presented below.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-FA-010	The defined processes to be followed in the event of data error discovery by either party shall be validated to ensure that identified data errors or ambiguities are addressed appropriately.	● D	● D		
DAL-FA-020	The defined contingency requirements concerning the continuity of data provision shall be validated to ensure that they are effective and that they do not contribute to any data errors.	● D	● D		
DAL-FA-030	Parties shall establish a process to monitor compliance with the formal arrangements requirements.	○	○	○	

4.4.4 Data Origination

4.4.4.1 Overview

NOTE: *This section should be read in conjunction with the DO Specification.*

Parties involved in data origination activities or requesting authorities need to comply with a number of requirements aimed at attaining a requisite quality and integrity level of aeronautical data and information.

The objectives defined here may be applicable to stakeholders that are not included in the scope of parties defined in the ADQ IR – refer to Section 1.5.2 in this DAL Specification. In these circumstances it is the responsibility of the requesting authority to ensure that the data quality is sufficient to be made available to the next intended user.

4.4.4.2 Application

The purpose of the data origination provision in relation to data quality is to ensure a consistent approach to the request, provision and quality assurance of aeronautical data and information. The requesting authority is responsible for instigating appropriate activities to ensure aeronautical data sources are up to date and origination complies with the Data Product Specification.

At the data origination stage it is vital that the data is acquired with the required accuracy, resolution and timeliness as specified by the requesting authority, and data integrity is assured from the point of acquisition. A consistent approach to the use of a defined co-ordinate reference system (defining both horizontal and vertical systems) is required in compliance to the relevant ICAO Annex provisions. These comprise the use of WGS-84 defining the horizontal reference system[18] and vertical measurement relative to mean sea level using the EGM-96 geoid model.

4.4.4.3 Objectives

4.4.4.3.1 Request for Data Origination

The objectives for requesting data origination activities that relate to Article 6(6) requirements are presented below.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-RDO-010	Parties responsible for requesting data origination shall establish mechanisms to ensure the currency of that data.	O	O	O	

4.4.5 Data Process Requirements

4.4.5.1 Overview

The data process requirements relate to the need to provide a level of process automation providing an effective and efficient means of processing aeronautical data and information. It is known that manual operations are inherently error prone and require support from a range of assurance activities to ensure that a defined data quality is attained from the data process.

4.4.5.2 Application

The need to automate the data process extends through all stages of the Aeronautical Data Chain. In practical terms the allocation of data processing between manual and

[18] The use of the International Terrestrial Reference Frame (ITRF) is from a practical point of view equivalent to WGS-84

automated tasks needs to be such that optimal compliance to data quality and other requirements is realised, although the emphasis should be on automation as far as practicable. At each stage in the Aeronautical Data Chain processes (implemented by Work Instructions and tools) are required to detect errors on the receipt of the data from a previous stage. Also, it is important not to introduce errors in any part of the process.

All parties involved in the Aeronautical Data Chain are required to review their data processes. The objective of this is to design and introduce an increased level of automated data processes that deliver data of the requisite quality. The review and evaluation process should take into consideration the available technology and process capability that be attained without adversely compromising the derived benefits.

For the entry of data into systems, and any manual data processing operations suitable verification must be considered to ensure that no errors are present or have been introduced during the process. The rigour with which the verification activities are conducted should be commensurate with the integrity level of the data items being processed. The objectives for manual entry of data, manual data processing operations and associated verification are discussed in section 4.1.4.2 and 4.3.4.

When introducing any form of changes to the data process, and accompanying assurance and support processes, it is important to develop plans and identify the activities that are needed to deliver the new system. The scope of these activities includes the development and implementation of the automation technology and accompanying Work Instructions and tools. Definitions of changes in roles and responsibilities are needed along with the training and skills requirements. Appropriate staff briefings and information bulletins should be provided. An appropriate level of system testing and trials should be conducted. If a substantial change from manual to automated processing is planned an incremental introduction of these new facilities should be considered to reduce the overall risk associated with the change.

The implementation of automation is part of the DPAL/TQL process which is described in section 4.1.4.2, and as such no further objectives are set for automation of data processes.

4.4.6 Error Reporting and Rectification

4.4.6.1 Overview

Error reporting and rectification is essential to ensure data quality, for the party itself and the parties who interface with it. The requirements for error reporting and rectification must be reflected in the data processes as well as the Formal Arrangements between parties. Error reporting should cover both aeronautical data errors and process errors. There are four components of the error reporting and rectification:

1. Discovered errors are recorded and reported by the finder to the appropriate party.
2. An impact assessment is conducted by the originating party and interim action is instigated to mitigate any immediate risks e.g. informing users of the data error.
3. Corrective and preventative action is taken to rectify the error and prevent further similar occurrences.
4. Error rate measures are recorded and reported.

4.4.6.2 Application

In principle each Member State is responsible for the co-ordination of error reporting and rectification for its Aeronautical Data Chain. In general an error reporting chain is established to the party that provided the data. This behaves as a well ordered feedback mechanism in the reverse direction to which the data is being transferred through the Aeronautical Data Chain. The process and Work Instructions used to manage error

reporting and rectification between parties should be included as part of the Formal Arrangements between them.

The factor of timeliness must be taken into account when reporting error to parties. The process of successively passing the reported error through a number of Aeronautical Data Chain stages may take some time. The parties need to expedite data error reporting since delays could compromise operational safety.

Data errors found at any stage of the Aeronautical Data Chain are recorded. Data errors may be discovered by inspection or validation checks when data is received from a party. They may also be found during subsequent processing. At the stage of discovery it is important to conduct a preliminary assessment to ascertain the potential compromise to safety and the urgency of any mitigating action required. This is particularly important if the data is already in use operationally, or the data is needed for operational use in a relative short timescale.

Errors must also be reported back along the Aeronautical Data Chain to the point where the error was introduced. Corrective action must be taken to rectify the error, the root cause and where necessary correct processes that failed to identify the error later in the chain.

It is important for all parties to maintain records of errors discovered in the process. Measurements of different types of error and their source are useful in instigating process improvements to elements of the Aeronautical Data Chain that are proving problematic. Recording and reviewing these error records at the Member State and at a European level provides valuable input in initiatives designed to improve operational safety.

4.4.6.3 Objectives for Aeronautical Data/ Information Error reporting

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-ER-010	The data error reporting and rectification mechanism[19] shall be validated to ensure it is working correctly.	● D	● D		

4.4.6.4 Objectives for Work Instructions and Tools Error reporting

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-ER-020	The Work Instructions and Tools error reporting and rectification mechanism shall be validated to ensure it is working correctly.	● D	● D		
DAL-ER-030	The adequacy of the mitigating action taken to prevent Work Instructions and Tools error propagation shall be validated.	● D	● D		

[19] As defined in Article 6(8) of the ADQ IR.

4.5. Consistency, Timeliness and Personnel Performance (Article 7)

4.5.1 Overview

The requirements for consistency, timeliness and personnel performance need to be satisfied at the Member State level with a subset of the requirements allocated to parties. The requirements directed to Member States relate to the consistency and integrity of the publications.

The requirements on parties comprise of ensuring staff are adequately briefed on the structure and composition of the aeronautical publications and their contribution to quality, including timeliness and consistency, of their part in the Aeronautical Data Chain. In addition, the parties must ensure that all staff are suitably trained and possess the skills for the tasks for which they are responsible. Records of training and retraining shall be held for a suitable period of time and made available to relevant persons on request.

4.5.2 Provisions

The provisions for consistency, timeliness and personnel performance are defined in the Article 7 of the ADQ IR.

4.5.3 Application

The provisions define a number of distinct requirements that must be satisfied. These requirements can be summarised as follows:

1. The duplication of data appearing in more than one State AIP, normally at boundary overlaps, needs to be reconciled to ensure consistency in each publication.
2. The requirement to clearly annotate the data or information items that do not meet the data quality requirements of the Regulation.
3. The current update cycles for AIP amendments and supplements are publicly available.
4. Parties' staff involved in aeronautical data processing, is made aware and apply the requirements for AIP amendments and AIP supplements, and NOTAM.
5. Staff involved in aeronautical data processing is suitably trained, possess the necessary skills, are motivated, and have the authorisation to perform their specific tasks.

The reconciliation of duplicated information appearing in more than one State AIP will be undertaken between the respective Member States. The role may be delegated to parties representing the Member State. The data items and information affected need to comply with all applicable requirements of the ADQ IR.

The requirement to clearly annotate the data or information items that do not meet the data quality requirements established to meet Article 6(1) of the Regulation is satisfied by both parties and Member State ensuring that processing records and metadata are maintained throughout the data processing. The processing records and metadata make it straightforward to determine and annotate data items/information that do not meet the stipulated data quality requirements.

Both Member States and parties need to ensure that the current update cycle information is publicly available relating to AIP amendments/supplements.

The awareness and application of the requirements for AIP amendments/supplements and NOTAM is an activity that needs to be planned and provided to all staff involved in data processing in the Aeronautical Data Chain. Staff briefing material can be prepared at the Member State level and distributed to parties. Alternatively, parties can prepare

and provide the training or briefings themselves. The delivery of the material can be presented in a number of ways that include formal training, briefing supported by guidance notes, and computer based learning.

Ensuring that all staff involved throughout Aeronautical Data Chain are adequately trained and have the necessary skills, competency, motivation, and authorisation to perform the range of data processing tasks they are assigned is the responsibility of the parties who need to plan and manage it as an integral part of human resource management.

4.5.4 Objectives

The objectives for the Consistency, Timeliness and Personnel Performance provision are presented for each element.

4.5.4.1 Consistency (Data Duplication)

The objectives are derived from ADQ IR Article 7(1) provision that requires aeronautical information service providers to ensure that there is consistency between duplicated information that is published.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-CT-010	Mechanisms shall be established to ensure consistency between aeronautical data or aeronautical information which is duplicated in one or more publications of the Member State.	O	O	O	
DAL-CT-020	Consistency checking required by DAL-CT-010 shall address as a minimum potential different representations of data, handling of last minute changes, and communication processes between departments handling the data.	O	O	O	

4.5.4.2 Data Quality Requirement

The provision of ADQ IR Article 7(2) requires that data/information is annotated to indicate where it does ***not*** meet the data quality requirements of the ADQ IR.

The “Guidelines for the AIP Annotation of ADQ non compliances” provides a possible methodology to implement this requirement. The guidelines are available online via the ADQ Library: http://www.eurocontrol.int/articles/adq-library

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-CT-030	The process employed to identify and annotate aeronautical data/information items in the AIP which do not meet the data quality requirements of the ADQ IR shall be validated.	● P	● P	● P	

4.5.4.3 Data Currency

The data currency provision, ADQ IR Article 7(3), requires that AISPs ensure that the most current updates of AIP amendments/supplements are publicly available.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-CT-040	Parties shall ensure that aeronautical data, information and products are processed and delivered to meet agreed IAIP publication deadlines as determined.	O	O	O	
DAL-CT-050	Parties shall plan the acquisition and processing of aeronautical data, information and associated products so as to allow publication in conformance to the AIRAC.	O	O	O	
DAL-CT-060	Processes shall be defined and implemented to ensure that any potential delays and last minute changes or cancellations are suitably dealt with.	O	O	O	
DAL-CT-070	A contingency plan shall be in place that addresses the arrangements in place in case of loss or temporary loss of ability to access or publish data.	O	O	O	
DAL-CT-080	The defined contingency arrangements shall be validated to ensure that they are effective and that they do not contribute to any data errors.	● D	● P	O	

4.5.4.4 Staff Training and Competency

The provision of ADQ IR Article 7(4) requires that personnel responsible for tasks in the provision of aeronautical data and information are made aware of and apply the requirements for AIP Amendments and Supplements and NOTAM and the update cycles applicable to the issue of AIP Amendments and Supplements.

The provision of ADQ IR Article 7(5) requires that staff responsible for aeronautical data and information tasks is trained, competent and authorised to conduct the activities. Staff records should be maintained to identify:

- Skills, competencies and training provided to each member of staff involved in data processing.
- Which staff are authorised to perform specified data processing activities.
- The shortfalls in skills and competency.

A training needs analysis should be conducted on introduction of changes to data processing or supporting activities to identify and provide any necessary training to the staff.

Finally, staff responsible for tasks in the provision of aeronautical data or information must have relevant experience and must be provided with the necessary supervisory support, resources and environment to enable them to effectively and efficiently perform their scope of work.

The objectives related to this provision are captured in the following table.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-STC-010	The skills and competency requirements shall be validated.	● D	● D		
DAL-STC-020	Parties shall retain or have access to a sufficient level of qualified and competent staff in order to perform duties as defined by the ADQ IR.	O	O	O	
DAL-STC-030	The processes established to ensure that each member of staff responsible for tasks in the provision of aeronautical data or information has been briefed or trained on the requirements of the ADQ IR shall be validated.	● D	● D		

4.6. Tools and Software Requirements (Article 8)

4.6.1 Overview

The scope of the ADQ IR (Article 2(1)) includes the EATMN systems and their constituents involved in the origination, production, storage, handling, processing, transfer and distribution of aeronautical data. EC Reg. No 552/2004 defines constituents as “tangible objects such as hardware and intangible objects such as software upon which the interoperability of EATMN depends”. Tools and software used for the support or automation of aeronautical data and information processing are therefore required to demonstrate an appropriate level of assurance of fitness for purpose through compliance with the relevant provisions of the ADQ IR. These Tools and software have the potential to both identify and contribute to data errors and to fail to detect data errors in aeronautical data/information.

The need to ensure that the Tools and software are robust is particularly applicable to support and processing Tools and software that is used for critical and essential data.

Software is addressed in so far as it is mandated in the ADQ IR and covers only those aspects of assurance that are within the responsibility of the ADQ IR regulated parties. Requirements on software to address Article 8 of the ADQ IR are included because ESARR 6 does not apply to all ADQ IR regulated parties. However, the DAL specification does not include objectives for the assurance of software development as this will be addressed within the software assurance standards chosen and agreed with the National authorities.

> **NOTE**: *The Conformity Assessment (CA) Guidelines, chapter 2.3.2 explains the specific roles of the various parties. Chapters 2.3.2.1 and 5 explain the specific role of Manufacturers.*

4.6.2 Provisions

The provisions for Tools and software requirements are defined in Article 8 and Annex V of the ADQ IR.

4.6.3 Application

A Tool Qualification Process (TQP) must be defined and followed when required.

Tool qualification needs to be performed within the context of the tool’s intended use, using EUROCAE ED-215/RTCA DO-330 with particular adaptations for aeronautical data processing as provided in EUROCAE ED-76A/RTCA DO-200B, section 2.4.5 and Appendix D.

4.6.4 Objectives

The Tool and software requirement objectives are presented below.

4.6.4.1 Data processing and data checking tools

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-TS-010	Software based Tools shall meet the requirements of a software safety assurance standard that is adequate for the TQL assigned to the tool.	O	O	O	

4.7. Data Protection (Article 9)

4.7.1 Overview

To ensure that data quality is maintained, suitable data protection measures are required to be implemented throughout the Aeronautical Data Chain, including processing, data exchange and storage.

The measures relate to all aspects of the activities concerned with the IAIP, obstacle data, terrain data and mapping data including people, data processing, data communications, hardware and software. The data protection measures need to address:

- **Confidentiality** – to protect commercially sensitive data exchanged before publication, or any commercial restrictions on its use.
- **Integrity** - to protect against intentional corruption of the data as well as against unintentional corruption.
- **Availability and Accessibility** - to ensure the IAIP is made available as and when required as well as to whomever requires access.
- **Completeness** – to ensure that the IAIP is provided to meet the requirements of its intended use.

4.7.2 Provisions

The provisions for data protection are defined in Article 9 and Annex VI of the ADQ IR.

4.7.3 Application

4.7.3.1 Overview

The application of the objectives for the data protection, storage and transfer covers all stages of the Aeronautical Data Chain. The data protection measures employed shall be documented in the quality management system that each organisation in the data chain should have.

The In-house processing, storage and transfer, of data are also subject to data protection, as detailed in the safety and security management system.

4.7.3.2 Data Origination Protection

As shown in Figure 7 of Section 3.5 data protection shall be applied to each stage of the Aeronautical Data Chain. Data at the Data Origination stage may be produced by State agencies such as National Survey Agencies or Military Data Providers. Therefore they are subject to this specification, and these bodies must have their own standards for the preparation and supply of data which shall be equivalent or greater than that specified here, in order to meet the required Data Assurance Level.

4.7.3.3 Data Transmission Protection

Data protection objectives need to be satisfied for all transfers between parties. Data transfer from the geographic / terrain data supplier shall be subject to data protection equivalent or greater than that specified here, in order to meet the required Data Assurance Level. Guidance material is found in CHAIN/0029, Section 2 – Principles of Exchange, and, Section 3.4 – Data Transmission.

There is a need to ensure data safety and security during data transmission. Data networks both private and especially public can be susceptible to both intentional and unintentional corruption. For data transmission it is recommended that data is protected by the use of:

- **Encryption**: Encryption offers protection of the confidentiality and integrity of data. Whilst the IAIP is a publicly available document once published, there may be confidential aspects in the data that should be protected before publication.
- **Digital certification**: Digital certification or digital signatures allow users to establish their qualification to send or receive data over a communications link with another organisation.
- **CRC:** The use of the CRC32Q algorithm is only for safety purposes which are concerned with unintentional, random corruption of data. A cyclic redundancy check offers protection against unintentional corruption of data by providing an alert that the data received is not as transmitted. However, it does not offer protection against intentional alteration of data taking place prior to data transmission.

4.7.3.4 Authentication

This gives assurance that the sender and receiver of data can each authenticate the identity of the other as being approved.

4.7.3.5 Non-Repudiation

Non-repudiation gives assurance that the sender of information is provided with proof of delivery and the recipient is provided with proof of the sender's identity, so neither can later deny having exchanged the information.

4.7.3.6 Data Storage Protection

At the Data Origination stage it shall be specified to the data originator that the data must be handled according to approved processes and stored in a protected environment. This is necessary for data requirements classified at DAL 1 or DAL 2. Parties acting as a Requesting Authority must take due consideration of this requirement.

4.7.4 Objectives

4.7.4.1 Data Transmission Protection

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DTP-030	Each party should implement a means of non-repudiation of data transactions to allow confidence in the data and to ensure traceability.	O	O	O	
DAL-DTP-040	Each party in the data chain should maintain records and archives of data transactions for critical and essential data to permit traceability.	O	O	O	

4.7.4.2 Data Storage Protection

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DP-010	Measures shall be taken to prevent loss, addition or unauthorised corruption of stored data.	O	O		
DAL-DP-020	Measures shall be taken to prevent malicious or unauthorised alteration or access to stored data.	O	O		

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DP-030	All data storage shall have appropriate processes and facilities for archiving and back-up of stored data.	O	O		
DAL-DP-040	It shall be ensured that operational systems are unable to access data used for test purposes.				
DAL-DP-050	Work Instructions shall be established to ensure that data values are kept in storage until they are marked to be withdrawn.	O	O	O	
DAL-DP-060	Where live data storage is shadowed, measures shall be taken to ensure that the shadow copy is kept up to date.	O	O		
DAL-DP-070	When data values are withdrawn they shall not be physically deleted but marked in a way such that: • the deletion information of the data value can be passed on to the next user; or • the information about the deletion process (when, who and the corresponding facts) are available.	O	O	O	

4.7.4.3 Data Processing Protection

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DP-080	Measures shall be employed to protect aeronautical data processing from corruption by other processes.	O	O		

4.7.4.4 Physical Security

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-DP-090	Security measures shall define areas in a party's facilities where aeronautical data may be securely stored and/or processed.	O	O	O	
DAL-DP-100	Secure areas shall be protected to prevent unauthorised access.	O	O		
DAL-DP-110	The employed methods of data storage shall provide reasonable protection against physical damage or degradation due to fire, water, aging or other mechanisms.	O	O		

4.8. Quality, Safety and Security Management Requirements (Article 10)

4.8.1 Quality Management System

4.8.1.1 Overview

All parties involved in supporting the Aeronautical Data Chain from origination through to publication and distribution are required to have implemented and be operating a quality management system (Article 10 of the ADQ IR) supporting the scope of their aeronautical data/information activities.

4.8.1.2 Provisions

The provisions for the quality management system are defined in Article 10(1) and Annex VII, Part A of the ADQ IR.

4.8.1.3 Application

All parties participating within the Aeronautical Data Chain from origination through to production, handling, processing, transfer and distribution of aeronautical data and information must establish an effective quality management system covering the scope of their aeronautical data and information activities.

Within the aeronautical standards and regulations extensive requirements and information exist on establishing and operating a quality management system. Further information on quality management systems can be found in documents such as EUROCAE ED-76, EURCAE ED-77, ICAO Document 8126, ICAO Annex 4 and ICAO Annex 15.

The ADQ IR states that the quality management system must also address safety management and security management requirements. However, parties can opt to keep safety and security as separate management systems. This decision should be based on the size of the organisation and the degree of diversity of the aeronautical data activities the party is managing.

4.8.1.4 Objectives

For parties holding a valid ISO 9001 Certificate it is assumed that this sub-chapter is adequately covered by the ISO QMS in place.

4.8.2 Safety Management

4.8.2.1 Overview

Parties are expected to implement safety management objectives in compliance with requirements placed for processing data and information. The safety management objectives can be satisfied as part of the organisations quality management system or as part of a separate safety management system. Safety management objectives are applicable to all DALs, but are subject to independent audit for DAL 1 and DAL 2.

4.8.2.2 Provisions

The provisions for safety management are defined in Article 10(2) and Annex VII, Part B of the ADQ IR.

4.8.2.3 Application

The achievement of the Safety Management objectives serves the ADQ IR provisions, which lay down a set of requirements for the provision of air navigation services. The requirements need to be interpreted for each of the Data Assurance Levels. As a general rule, those parties dealing with aeronautical data / information pertaining to DAL 1 will be required to comply as appropriate to all the safety management requirements. The objectives for aeronautical data / information under DAL 2 and DAL 3 are less rigorous.

The following aspects need to be considered in addressing the safety management requirements:

- Provision of a management system that addresses the safety management objectives and includes the scope of aeronautical data / information operations.
- Achievement of safety requirements, e.g. adequately trained / competent staff, documentation and records.
- Safety assurance.
- The promotion of safety with the organisation.
- Safety requirements for risk assessment and mitigation with regard to changes in data processing and / or supporting arrangements.
- Safety requirements for engineering and technical personnel undertaking operational safety related tasks.

These are addressed in the objectives below.

4.8.2.4 Objectives

The DAL objectives for the safety management requirements are presented below. These objectives provide the basic framework for establishing, managing and operating safety management system for aeronautical data/information activities conducted within an organisation.

4.8.2.4.1 General Safety Management

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-SM-010	A Safety Policy shall be developed and implemented covering the scope of aeronautical data and information activities with which the party is involved and committing the party to a business objective for safety that minimises its contribution to aviation accident risk to as low as reasonably practicable.	O	O	O	
DAL-SM-030	Remedial actions shall be undertaken within the party to ensure safety risks are reduced to levels that are as low as reasonably practicable.	O	O	O	
DAL-SM-040	The scope of the Safety Management Procedures shall include due consideration of aeronautical data and information interfaces at the boundaries of the party's scope of service (upstream, downstream, and peripheral activities).	O	O	O	

4.8.2.4.2 Safety Responsibility

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-SM-050	The Safety Management Procedures shall define the roles and responsibilities allocated to each of the actors in relation to the safety management objectives.	O	O		

4.8.2.4.3 Safety Records and Safety Monitoring

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-SM-060	Relevant safety regulations, standards and notices shall be periodically reviewed to ensure conformance of the Safety Management Procedures.	O	O	O	

4.8.2.4.4 Safety Promotion and Safety Improvement

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-SM-070	The Safety Policy shall be communicated to all employees with the intent that they are made aware of their individual safety obligations.	O	O	O	

4.8.3 Security Management Objectives

4.8.3.1 Overview

All parties shall implement security management objectives to provide adequate security measures including security management, protection of the party's physical environment, and data access and processing activities. The security management objectives shall include security objectives placed on all suppliers of data and of supporting services.

As with the safety management objectives, a small organisation involved in processing routine data can generally satisfy the applicable objectives by embedding the security management objectives as an integral part of the party's quality management system.

4.8.3.2 Provisions

The provisions for security management are defined in Article 10(2) and Annex VII, Part C of the ADQ IR.

4.8.3.3 Application

Security of the facilities and the data is critical for organisations that are responsible for managing, processing and exchanging aeronautical data. The security of the data may be compromised at a number of levels within an organisation, or at the interface with other organisations. This may result in disruption of the party's business or data processing thus compromising their ability to deliver the requisite uncorrupted data in time. A more subtle breach of security may result in the introduction of data errors that may not be detected until in operation, compromising the safety of operations.

All parties participating in aeronautical data/information processing will need to implement the security management objectives commensurate with the data assurance level of data/information they are managing.

There are a number of general industry standards and best practice guides available including, but not limited to;

- ISO 17799:2005 and 28000:2005 referenced in the ADQ IR.
- ISO 27001 (new designation of ISO 17799) – *Information technology - Security techniques - Information security management systems – Requirements*: this is not a specification but a code of practice providing guidelines for developing organisation security standards and effective security management practices.
- ISO 27002: Information Technology – Security Techniques – Code of Practice for Information Security Management.
- ISO 28001 Security management systems for the supply chain - *Best practices for implementing supply chain security, assessments and plans - Requirements and guidance:* specifies the requirements for a security

management system including those aspects critical to security assurance of the supply chain.

4.8.3.4 Objectives

These objectives provide the basic framework for establishing, managing and operating a security management system for aeronautical data/information activities conducted within an organisation.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-CM-010	A Security Policy shall be developed and implemented covering the scope of aeronautical data and information activities with which the party is involved.	O	O	O	
DAL-CM-030	Relevant security regulations, standards, and notices shall be periodically reviewed to ensure conformance of the Security Management Procedures.	O	O	O	
DAL-CM-040	All suppliers of data shall have security requirements appropriate to their tasks placed on them by means of formal arrangements.	O	O	O	

5 CONFORMITY ASSESSMENT AND ADDITIONAL REQUIREMENTS

5.1. Conformity or Suitability for Use of Constituents (Article 11)

The provisions of Article 11 of the ADQ IR are not within the scope of the DAL Specification as these provisions relate to the assessment of compliance with the ADQ IR. The EUROCONTROL Guidelines on Conformity Assessment provide guidance on conformity assessment of EATMN systems and constituents with the essential requirements (ERs) and all IRs relevant to the interoperability regulation EC Reg. No. 552/2004.

5.2. Verification of Systems (Article 12)

As with Article 11, the provisions of Article 12 of the ADQ IR are not within the scope of the DAL Specification as these provisions relate to the assessment of compliance with the ADQ IR. The EUROCONTROL Guidelines on Conformity Assessment provide guidance on conformity assessment of EATMN systems and constituents with the essential requirements (ERs) and all IRs relevant to the interoperability regulation EC Reg. No. 552/2004.

5.3. Additional Requirements (Article 13)

5.3.1 Overview

The provisions defined in Article 13 cover a number of general areas:

- Staff security clearance.
- Staff awareness of scope and content of the Regulation.
- Development, maintenance and availability of process manuals.

It should be noted that these provisions do not apply to ANSPs. They only apply to parties referred to in Article 2(2)(b) and (c), because equivalent provisions for ANSPs are already defined by Commission Implementing Regulation (EU) 1035/2011 of 17 October 2011 laying down common requirements for the provision of air navigation services, particularly in Article 4, Annex I and Annex IV.

5.3.2 Provisions

The provisions for the additional requirements for parties referred to in Article 2(2)(b) and (c) are defined in Article 13 of the ADQ IR.

5.3.3 Application

The additional requirements cover a number of areas that need to be satisfied. In general where the party is processing critical or essential data items then these requirements must be met. For parties involved in processing or handling routine data items only it is desirable that they satisfy the requirements but this depends on the roles of individual staff and the authority they have and their access to communications networks.

5.3.3.1 Security Clearance

For personnel participating in the management, processing and handling of aeronautical data or that have access to data processing facilities or communication networks, security clearance is required.

The responsibility for setting the standard of the security clearance lies with each Member State. Parties should comply with the appropriate national regulations and guidance and use any national resources that are available.

5.3.3.2 Regulation Awareness

All parties involved in the Aeronautical Data Chain are required to make all staff aware of the ADQ IR and its contents. The ADQ IR provision requires that all staff is made aware of its requirements.

The planning of the ADQ IR into force will require EUROCONTROL and Member States to prepare. As part of this activity, briefing material will be made available to parties. Attendance of meetings and briefings held by EUROCONTROL and Member States should provide parties with material on which to develop briefing material for their staff. It is recommended that the ADQ IR briefing material should be accompanied with references to the operation manual to provide the context in which aeronautical data and information processing is conducted.

As an integral part of new employee induction or the use of new contract staff engaged to perform aeronautical data and information processing activities the briefing material is presented to them.

5.3.3.3 Operations Manuals

The ADQ IR provision requires that:

- Current Operations Manuals[20] are made available to staff. These should cover the ADQ IR requirements relevant to work processes and procedures.
- Assurance that the defined work processes and procedures are being followed.

Operations manuals are developed for the scope of work covered by the ADQ IR provisions. The scope of work includes all aspects of the ADQ IR provisions applicable against the organisation, assurance, data processing and support levels.

It is anticipated that the operations manuals will involve a reasonable amount of effort to develop. For those parties that already have documentation for existing practices the development will be more of an adaptation and enhancement activity to bring the process manuals in line with the applicable ADQ IR provisions.

In recognition that for some parties the development of the operations manuals will entail a substantial amount of effort it is recommended that a start is made on their preparation some time before the ADQ IR comes into force.

For all parties the planning of the development of the operations manuals is necessary to estimate the effort required and the scope of resources required. Some of the material is expected to be derived from EUROCONTROL and Member States in their preparations for the ADQ IR.

The operations manuals should be developed to documentation standards defined in the Party's quality management system. A formal review of the operations manuals is recommended to be conducted prior to release and for all updates. The operations manuals must be maintained under configuration control with an update history held within the document itself or recorded in a document register.

The current operations manuals and copies of the manuals, as applicable, are made available as reference material for all staff involved directly or indirectly in aeronautical data and information processing.

[20] In this DAL Specification "Operations Manuals" are part of the generic term Working Instructions.

Assurance that the defined work processes and procedures are being followed can be achieved by audits, reviews and inspections. The results of these assurance activities will be formally recorded along with any corrective actions that are necessary.

5.3.4 Objectives

5.3.4.1 Security Clearance

These objectives aim at ensuring that all employees and contractors involved either directly or indirectly in aeronautical data and information activities have sufficient security clearance.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-AR-010	The requirements for security assessment and clearance shall be integrated with the recruitment or application process for new staff and contractors.	O	O	O	
DAL-AR-020	Security assessment and clearance shall be conducted for all staff requiring access to secure areas (as defined in the response to DAL-DP-090)	O	O	O	
DAL-AR-030	A basic employment check on all staff shall be conducted.	O	O	O	

5.3.4.2 Regulation Awareness

The objectives aim to ensure that all parties provide their employees/contractors with sufficient knowledge and understanding of the Regulation and its provisions.

Objective Reference	Objective	DAL 1	DAL 2	DAL 3	Remarks
DAL-AR-040	All parties shall prepare briefing material that covers the applicable provisions of the ADQ IR.	O	O	O	
DAL-AR-050	ADQ IR briefings shall be presented to all employees/contractors using an appropriate medium.	O	O	O	
DAL-AR-060	Parties shall update their ADQ IR briefing material as changes to the ADQ IR occur.	O	O	O	

5.3.4.3 Operations Manuals

The operation manual covers all processes and procedures involved in aeronautical data and information activities that include all applicable aspects of the ADQ IR. Article 13(c) is addressed by the objectives within this specification pertaining to Work Instructions and quality, safety and security management in sections 4.1 and 4.8 respectively.

ANNEX A CONFIGURATION CONTROL

A.1 MoC ELEMENT IDENTIFICATION

MoC_Name	MoC_ID	MoC_Edition
EUROCONTROL Specification for Data Assurance Levels	EUROCONTROL-SPEC-0148	1.1

A.2 MoC ELEMENT CHANGE RECORD

The following table records the complete history of the successive editions of MoC specifications.

Specification Document Identifier	Edition Number	Edition Date	Reason for Change	Sections Affected
EUROCONTROL-SPEC-0148	1.1	28/03/2018	Revised Specification	All

A.3 MoC ELEMENT TRACEABILITY TOWARDS REGULATORY PROVISIONS

The following table records the traceability history of regulatory provisions associated with this MoC element.

Specification Document Identifier	Edition Number	Implementing Rule References	References of Regulatory Provisions	Validation Date
EUROCONTROL-SPEC-0148	1.1	Commission Regulation (EU) 73/2010	Article 6(2)	

ANNEX B CONFORMITY MATERIAL

This section specifies the conformity assessment material available for the MoC specified in this EUROCONTROL Specification, in Chapter 4 and Chapter 5.

Applicants claiming conformance to this EUROCONTROL Specification should complete the Conformance Statement below.

NOTE: The column usually used for stating if the objective is mandatory/optional/conditional was intentionally not included in this Conformance Statement because it could lead to misinterpretation due to the particularities of the DAL Specification (obligations changing according to the levels of assurance). EUROCONTROL will provide additional separate material (guidance, MS Excel tables …) to support the completion of the Conformance Statement.

B.1 Objectives

Identifier	Feature	Dependency
DAL-EV-010	Removed with Edition 1.1	
DAL-EV-020	Handling aeronautical data	
DAL-EV-030	Handling aeronautical information products	
DAL-EV-040	Removed with Edition 1.1	
DAL-EV-050	Removed with Edition 1.1	
DAL-EV-060	Removed with Edition 1.1	
DAL-EV-070	In service records	
DAL-EV-080	ISO 9001 Certificate	
DAL-PRC-010	Definition of Work Instructions	
DAL-PRC-020	Classification of Work Instructions	
DAL-PRC-030	Validation of the Work Instructions classification	DAL-PRC-020
DAL-PRC-040	Removed with Edition 1.1	
DAL-PRC-050	Assignment of DPAL for data processing Work Instructions	
DAL-PRC-060	Assignment of DPAL for data checking Work Instructions	
DAL-PRC-070	Assignment of DPAL for mixed Work Instruction	
DAL-PRC-080	Verification of DPAL assignments	DAL-PRC-050;DAL-PRC-060
DAL-PRC-090	Removed with Edition 1.1	
DAL-PRC-100	Removed with Edition 1.1	
DAL-PRC-110	Removed with Edition 1.1	
DAL-PRC-120	Removed with Edition 1.1	

Identifier	Feature	Dependency
DAL-PRC-130	Removed with Edition 1.1	
DAL-PRC-140	Removed with Edition 1.1	
DAL-PRC-150	Removed with Edition 1.1	
DAL-PRC-160	Representatives of stakeholders involved in the definition of the Work Instructions	
DAL-PRC-170	Relevant published material used in the definition of the Work Instructions	
DAL-PRC-180	Validation of the Work Instructions	
DAL-PRC-190	Assessment of the party's overarching process for handling aeronautical data/information	
DAL-PRC-200	Validation of Work Instructions as not contributing to data errors	
DAL-PRC-210	Analyse of data checking Work Instructions to identify how the Work Instruction can fail to detect data errors	
DAL-PRC-220	Validation of Work Instructions involving transformations from one format to another to identify possible ambiguities and anomalies	
DAL-PRC-230	Validation of Work Instructions through relevant stakeholder group review	
DAL-PRC-240	Validation of Work Instructions through pre-implementation trials	
DAL-PRC-250	Removed with Edition 1.1	
DAL-PRC-260	Approval of Work Instructions at the Organisation Functional Level	
DAL-DS-010	Verification of the implementation of the data set	
DAL-DS-020	Applied version of the data set agreed as part of the Formal Arrangements	
DAL-DE-010	Removed with Edition 1.1	
DAL-DE-020	Removed with Edition 1.1	
DAL-DE-030	Validation of the application of the CRC within the data exchange mechanism	
DAL-DE-040	Verification that the source data is from an authorised source	
DAL-DE-050	Verification that the data received from unauthorised sources is verified with the authorised source of that data	
DAL-DE-060	Data that cannot be verified with the authorised source is not used	
DAL-DE-070	Documentation that identifies all the data item suppliers and the approval status of the data item	
DAL-DE-080	Reasonableness checks	
DAL-DE-090	Inform data supplier of any error discovered during the data reasonableness checks	
DAL-DE-100	Verification of data received by means other than electronic and/or where manual entry of data is required	
DAL-DE-110	Data exchange format standard and mechanism which are to be used documented in the Formal Arrangements	

Identifier	Feature	Dependency
DAL-DE-120	Validation of the implementation of the data exchange standard format and mechanism	
DAL-DE-130	Verification procedures	
DAL-DE-140	Validation of verification procedures	DAL-DE-140
DAL-DE-150	Removed with Edition 1.1	
DAL-DE-160	Removed with Edition 1.1	
DAL-DE-170	Removed with Edition 1.1	
DAL-DE-180	Evaluation of the positional accuracy of features assigned a critical data integrity level	
DAL-DE-190	Methodology to use where the positional accuracy cannot be evaluated by direct means and is estimated by indirect means.	
DAL-DE-200	Removed with Edition 1.1	
DAL-DE-210	Removed with Edition 1.1	
DAL-DE-220	Removed with Edition 1.1	
DAL-FA-010	Validation of the processes to be followed in the event of data error discovery	
DAL-FA-020	Validation of the contingency requirements concerning the continuity of data provision	
DAL-FA-030	Monitor compliance with the formal arrangements	
DAL-RDO-010	Currency of the data	
DAL-ER-010	Validation of the data error reporting and rectification mechanism	
DAL-ER-020	Validation of the Work Instructions and Tools error reporting and rectification mechanism	
DAL-ER-030	Validation of the mitigating action taken to prevent Work Instructions and Tools error propagation	
DAL-CT-010	Mechanisms to ensure consistency between aeronautical data or aeronautical information which is duplicated in one or more publications of the Member State	
DAL-CT-020	Consistency checking principles	
DAL-CT-030	Annotation of aeronautical data/information items which do not meet the data quality requirements	
DAL-CT-040	IAIP publication deadlines	
DAL-CT-050	Publication in conformance to the AIRAC	
DAL-CT-060	Dealing with potential delays and last minute changes	
DAL-CT-070	Contingency plan in case of loss or temporary loss of ability to access or publish data.	
DAL-CT-080	Validation of contingency plan	DAL-CT-070

Identifier	Feature	Dependency
DAL-STC-010	Validation of the skills and competency requirements	
DAL-STC-020	Retain or have access to a sufficient level of qualified and competent staff	
DAL-STC-030	Validation of the processes for briefing and training on the ADQ IR provisions	
DAL-TS-010	Software safety assurance levels	
DAL-TS-020	Analysis to detect how the data processing Tools can contribute and identify data errors	
DAL-TS-030	Additional appropriate checks for data errors caused by data processing Tools that were not detected	
DAL-TS-040	Mitigation of data errors caused by the data processing tools	
DAL-TS-050	Analysis to detect how the data checking Tools can fail to detect data errors	
DAL-TS-060	Additional appropriate checks for errors not detected by data checking tools	
DAL-TS-070	Mitigation of data errors not detected by data checking tools	
DAL-TS-080	Identification and warning of anomalies and ambiguities that can arise from data transformations	
DAL-TS-090	Tools shall be designed such that when checking data it cannot modify the data	
DAL-TS-100	Security controls to prevent the introduction of malicious or unauthorised software	
DAL-TS-110	Verification of data processing Tools both under normal and abnormal operating conditions	
DAL-TS-120	Verification of data checking Tools under normal operating conditions	
DAL-TS-130	Validation of Tools through pre-operational trials	
DAL-TS-140	Verification of bespoke Tools in accordance with the software safety standard identified in the TQP	
DAL-TS-150	Verification of data checking Tools after modifications	
DAL-TS-160	Verification of data processing Tools after modifications	
DAL-TS-170	Mitigation where compliance cannot be demonstrated	
DAL-TS-180	Verification of mitigations	DAL-TS-170
DAL-TS-190	Further qualification of tools, in accordance with the Tool Qualification Process, after modifications	
DAL-TS-200	Tool Roll Out Plan	
DAL-TS-210	Tool Roll Out Plan agreed with stakeholders	
DAL-TS-220	Feedback to relevant stakeholders on the transfer of a Tool into operation	
DAL-TS-230	Tool Configuration Management Procedure	

Identifier	Feature	Dependency
DAL-TS-240	Verification of the Tool Configuration Management Procedure	DAL-TS-230
DAL-TS-250	Consider modifying Tools where Tool enhancements are identified which provide positive data quality benefit	
DAL-DTP-010	Removed with Edition 1.1	
DAL-DTP-020	Removed with Edition 1.1	
DAL-DTP-030	Non-repudiation of data transactions	
DAL-DTP-040	Maintain records and archives of data transactions for critical and essential data	
DAL-DTP-050	Removed with Edition 1.1	
DAL-DTP-060	Removed with Edition 1.1	
DAL-DP-010	Prevention against loss, addition or unauthorised corruption of stored data	
DAL-DP-020	Prevention against malicious or unauthorised alteration or access to stored data	
DAL-DP-030	Processes and facilities for archiving and back-up of stored data	
DAL-DP-040	Operational systems are unable to access data used for test purposes	
DAL-DP-050	Measures for storing measured, calculated and derived data values that are withdrawn	
DAL-DP-060	Measures for live data storage that is shadowed	
DAL-DP-070	Measures for marking measured, calculated or derived data values that are withdrawn	
DAL-DP-080	Measures to protect aeronautical data processing from corruption by other processes	
DAL-DP-090	Definition of secure areas	
DAL-DP-100	Protection of secure areas	
DAL-DP-110	Protection of stored data against physical damage or degradation	
DAL-SM-010	Safety Policy	
DAL-SM-020	Removed with Edition 1.1	
DAL-SM-030	Remedial actions for safety risks	
DAL-SM-040	Safety in the aeronautical data and information interfaces at the boundaries of the party's scope of service	
DAL-SM-050	Roles and responsibilities allocated in relation to the safety management objectives	
DAL-SM-060	Periodical review of safety regulations, standards and notice	
DAL-SM-070	Communication of the Safety policy	
DAL-CM-010	Security Policy	
DAL-CM-020	Removed with Edition 1.1	

Identifier	Feature	Dependency
DAL-CM-030	Periodical review of security regulations, standards and notices	
DAL-CM-040	Security requirements for data suppliers	
DAL-AR-010	Staff security assessment and clearance in the recruitment processes	
DAL-AR-020	Security assessment and clearance for secure areas	DAL-DP-090
DAL-AR-030	Employment checks	
DAL-AR-040	Preparation of ADQ IR briefing material	
DAL-AR-050	Communication of ADQ IR briefing material	
DAL-AR-060	Update of ADQ IR briefing material	

Attention: As mentioned in section 2.4.1, all objectives with numbers in the range of 500 to 600 have been removed since it is assumed that all parties are compliant with ISO 9001 QMS.

ANNEX C TRACEABILITY TO REGULATORY PROVISIONS

This Annex provides traceability from the Articles and Annexes of Commission Regulation (EU) 73/2010 to the detailed technical provisions of the EUROCONTROL Specification for Data Assurance Levels.

C.1 Article 6(2) and Annex IV, Part B : Evidence Requirements

Annex IV, Part B Ref	Annex IV, Part B Requirement Text	DAL Specification Section – IR Article
(a)	Accuracy and resolution requirements are achieved at data origination and maintained through to publication to the next intended user, including, whenever the resolution of a data item is reduced or changed, or the data is translated into a different co-ordinate system or unit of measurement.	Addressed by the objectives in Section 4.2, Section 4.3, Section 4.4.4 and Section 4.7
(b)	The origin and change history for each data item is recorded and available for audit.	Addressed by the objectives in Section 4.2
(c)	The data or information is complete or any missing items are declared.	Addressed by the objectives in Section 4.2 Section 4.5
(d)	All data origination, production, storage, handling, processing, transfer or distribution processes used for each data item are defined and adequate for the assigned level of integrity of the data item.	Adequacy objectives for all data processes are addressed by the objectives in Section 4.1.4.2 For data origination by the objectives in Sections 4.4.4 and 4.4.5[21] For data production, handling and processing by the objectives in Section 4.2 and Section 4.5 For data storage, transfer and distribution processes by the objectives in Section 4.3, Section 4.4.5, Section 4.4.6, Section 4.5 and Section 4.7
(e)	Data validation and verification processes are adequate for the assigned integrity level of the data item.	Adequacy objectives for all data processes are defined in the tables in section 4.1.4.2
(f)	Manual or semi-automated data processes are performed by trained and qualified staff, with clearly defined roles and responsibilities that are recorded in the party's quality system.	Addressed by the objectives in Sections 4.4.5, Section 4.5 and Section 4.8
(g)	All Tools and/or software used to support or implement the processes are validated as fit for purpose in accordance with Annex V	Addressed by the objectives in section 4.6
(h)	An effective error reporting, measurement and corrective action process is in operation in accordance with Part F.	Addressed by the objectives in section 4.4.6

[21] Data origination requirements are specified in the Data Origination (DO) Specification and only objectives related to data quality are included in the DAL Specification.

C.2 Other Articles and Annexes

Specific Regulatory Provisions	Specification Reference
Article 4 and Annex I – Data set	See section 4.2.4
Article 5(1) – Data Exchange (*Direct Electronic Connection*)	See section 4.3.4.1
Article 5(2) and Annex II – Data Exchange (*Data Exchange Format*)	See section 4.3.4.2
Article 6(1) and Annex IV, Part A – Data Quality (*Data Quality Requirements*)	See DQR Specification
Article 6(2) and Annex IV, Part B – Data Quality (*Evidence Requirements*)	Annex C, Section C.1 of this Specification
Article 6(3) and Annex IV, Part C – Data Quality (*Formal Arrangements*)	See section 4.4.3.3
Article 6(4) and Annex IV, Part D – Data Quality (*Data Origination*)	See DO Specification
Article 6(5) – Data Quality (*Data Origination*)	See DO Specification
Article 6(6) – Data Quality (*Request for Data Origination*)	See section 4.4.4.3.1
Article 6(7) and Annex IV, Part E – Data Quality (*Data Process Requirements*)	See section 4.4.5
Article 6(8) and Annex IV, Part F – Data Quality (*Error Reporting, Feedback and Rectification*)	See section 4.4.6
Article 7(1) – Consistency, Timeliness and Personnel Performance (*Consistency*)	See section 4.5.4.1
Article 7(2) – Consistency, Timeliness and Personnel Performance (*Annotation of non-compliances*)	See section 4.5.4.2
Article 7(3) – Consistency, Timeliness and Personnel Performance (*Data Currency*)	See section 4.5.4.3
Article 7(4) – Consistency, Timeliness and Personnel Performance (*Personnel Performance*)	See section 4.5.4.4
Article 7(5) – Consistency, Timeliness and Personnel Performance (*Personnel Performance*)	See section 4.5.4.44.5.4.4
Article 8 and Annex V – Tools and Software Requirements	See section 4.6.4
Article 9 and Annex VI – Data Protection	See section 4.7.4
Article 10(1) and Annex VII, Part A – Quality Management, Safety and Security Requirements (*Quality Management*)	See section 4.8.1
Article 10(2) and Annex VII, Part B – Quality Management, Safety and Security Requirements (*Safety Management*)	See section 4.8.2
Article 10(2) and Annex VII, Part C – Quality Management, Safety and Security Requirements (*Security Management*)	See section 4.8.3
Article 11 and Annex VIII – Conformity or Suitability for Use of Constituents	Not in scope, see section 5.1
Article 12 and Annex IX and Annex X– Verification of Systems	Not in scope, see section 5.2
Article 13 – Additional Requirements	See section 5.3.4

ANNEX D SPECIFICATION UPDATE PROCEDURES

It is necessary to periodically check this EUROCONTROL Specification for consistency with referenced material, notably ICAO SARPS and relevant Regulations. The Specification is also expected to evolve following real project and field experience, as well as advances in technology. The main objectives of a regular review are:

a) to improve the quality of the requirements (e.g. clarity, testability, etc.);
b) to verify that the level of detail published is adequate;
c) to ensure that design-oriented requirements, imposing unnecessary constraints to technical solutions, have been avoided;
d) to ensure that advances in technology are properly reflected;
e) to make all stakeholders incl. industry aware of the latest developments.

The update process for this EUROCONTROL Specification may be summarised as follows:

Stakeholders may provide change proposals either through existing working arrangements (e.g. established working groups) or by sending a formal Change Request (CR) to the generic email address: standardisation@eurocontrol.int

The CR needs to provide following minimum elements:

- Originator information (name, Organisation, contact details)
- Specification title, number and edition date
- Page, chapter, section (subsection) where the issue appears
- Description of the issue and reason for change
- Specific change proposal text (incl. potential alternatives, if any).

Main steps towards a revised version:

- Agency (Standardisation unit) will assess each CR in coordination with content owners, classify the urgency and establish the CR impact category (major, minor or editorial).
- Agency will then prepare resolution proposal(s) and, if needed, discuss those with the originator and/or relevant working arrangements. Note: CR will be grouped into “change packages” to consider reasonable update cycles.
- Agreed changes will be integrated into a revised version “Proposed Issue” including a summarised list of changes.
- Consultation will be performed in accordance with the CR impact category identified:
    - Major changes require full formal stakeholder consultation (PC level)
    - Minor changes need consultation at working layers (e.g. working group or Team)
    - Editorial changes may be implemented directly at any stage though grouped with change packages.

Note: Identified errors which may cause potential problems when implementing, may be corrected directly via separate “Corrigendum”.

The Agency will apply this process in an objective and impartial way and will consult stakeholders as needed and in line with the formal Standards Development Process.

ANNEX E REFERENCES

Brief Form for the Reference	Detailed Reference
ADQ IR	Commission Regulation (EU) No 73/2010 of 26 January 2010 laying down requirements on the quality of aeronautical data and aeronautical information for the single European sky, as amended by Commission Implementing Regulation (EU) No 1029/2014
ICAO Annex 14	ICAO Annex 14 – Aerodromes
ICAO Annex 15	ICAO Annex 15 - Aeronautical Information Services
EC Reg. No. 552/2004	Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the Interoperability of the European Air Traffic Management Network
EC Reg. No 1070/2009	Regulation (EC) No 1070/2009 of the European Parliament and of the Council of 21 October 2009 amending Regulations (EC) No 549/2004, (EC) No 550/2004, (EC) No 551/2004 and (EC) No 552/2004 in order to improve the performance and sustainability of the European aviation system
EC Reg. No 482/2008	Commission Regulation (EC) No 482/2008 of 30 May 2008 establishing a software safety assurance system to be implemented by air navigation service providers and amending Annex II to Regulation (EC) No 2096/2005
EU Reg. No 1034/2011	Commission Implementing Regulation (EU) No 1034/2011 of 17 October 2011 on safety oversight in air traffic management and air navigation services
EU Reg. No 1035/2011	Commission Implementing Regulation (EU) 1035/2011 of 17 October 2011 laying down common requirements for the provision of air navigation services
EU Reg. No 2017/373	Commission Implementing Regulation (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight
Note: Other Commission Regulations are only referenced once in full in the text	
CHAIN/0029	EUROCONTROL CHAIN – Integrity of Aeronautical Information – Data Exchange
CHAIN/0056	EUROCONTROL CHAIN – Service Level Agreement - Guidance
AIX Specification	EUROCONTROL Specification for Aeronautical Information Exchange; Ed. 1.0, dated 14/12/2012
DO Specification	EUROCONTROL Specification for the Origination of Aeronautical Data (Volume 1), Ed.1, dated 04/02/2013
DQR Specification	EUROCONTROL Specification for Data Quality Requirements, Ed. 1.2, dated 25/02/2016
eAIP Specification	EUROCONTROL Specification for the Electronic Aeronautical Information Publication (eAIP); Ed. 2.1; dated 06/10/2015
ADQ Guide	EUROCONTROL Guidelines for Supporting the Implementation of Commission Regulation (EU) 73/2010; Ed 1.6, dated 06.01.2017
ED-76A	RTCA/EUROCAE ED 76 (Standards for Processing Aeronautical Data)
ED-77	RTCA/EUROCAE ED 77 (Standards for Aeronautical Information)
ED-99D	RTCA/EUROCAE ED 99 (User Requirements for Aerodrome Mapping Information)
ED-215	ED-215 Software Tool Qualification Considerations
Guidelines on Conformity Assessment	EUROCONTROL Guidelines on Conformity Assessment for the Interoperability Regulation of the Single European Sky; Ed. 3.0; 20/02/2012
ICAO Doc 8126	Aeronautical Information Services Manual, Edition 6, 2003 (AMDT No 2, dated 28/9/09)
ISO 19110:2016	ISO 19110 Geographic information -- Methodology for feature cataloguing, Edition 2, 2016
ISO 19131:2007	ISO 19131:2007 Geographic Information – Data Product Specifications
ISO 9001	ISO 9001:2015 Quality Management Systems – Requirements, Edition 5, September 2015 *Note: The publication of ISO 9001:2015 in September 2015 started a 3-year transition period. Therefore, certifications to ISO 9001:2008 will no longer be valid after September 2018.*
Note: Other ISO standards are only referenced once in full in the text	

Brief Form for the Reference	Detailed Reference
prEN16154	Air Traffic Management – Software Assurance Levels
AIS Data Process	EUROCONTROL, AIS Data Process, Edition 2.0, July 2009
Static Data Procedures	EUROCONTROL, Operating Procedures for AIS Static Data, SDP 0 to 19, SDP-G and SDP-C, Edition 2.0, July 2009
UML Specification	Object Management Group Unified Modelling Language Specification
JCGM 100:2008	JCGM 100:2008 Evaluation of measurement data — Guide to the expression of uncertainty in measurement, First edition 2008, Corrected version 2010
US NIST SP800-53	National Institute of Standards and Technology (United States Department of Commerce) Special Publication 800-53, Recommended Security Controls for Federal Information Systems and Organizations, Revision 4

ANNEX F TABLE OF ABBREVIATIONS

Abbreviation	Expansion
ADQ	Aeronautical Data Quality
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation And Control
AIS	Aeronautical Information Service
AISP	Aeronautical Information Service Provider
ANSP	Air Navigation Service Provider
ATM	Air Traffic Management
CA	Conformity Assessment
CHAIN	Controlled and Harmonised Aeronautical Information Network
COTS	Commercial Off The Shelf
CRC	Cyclic Redundancy Check
DAL	Data Assurance Level
DIL	Data Integrity Level
DO	Data Origination
DPAL	Data Processing Assurance Level
DQR	Data Quality Requirement(s) (draft specification on DQR)
eAIP	Electronic AIP
EATMN	European Air Traffic Management Network
ERAF	EUROCONTROL Regulatory and Advisory Framework
EUROCAE	European Organisation for Civil Aviation Equipment manufacturers
IAIP	Integrated Aeronautical Information Package
ICAO	International Civil Aviation Organisation
IR	Implementing Rule
ISO	International Organisation for Standardisation
MoC	Means of Compliance
NOTAM	NOTice to AirMen
QMS	Quality Management System
SES	Single European Sky
SLA	Service Level Agreement
SMS	Safety Management System
TQL	Tool Qualification Level
TQP	Tool Qualification Process
WGS-84	World Geodetic System 1984
XML	Extensible Markup Language

ANNEX G DEFINED TERMS

Term	Explanation
Aeronautical Information Service Provider	The organisation responsible for the provision of an aeronautical information service, certified in accordance with EU Regulation No. 1035/2011 or 2017/373, respectively.
Authorised and Approved Source	An entity that is authorized by a legal authority to develop or manage data for a specific business purpose.
Basic Employment Check	A background employment check to verify the identity of the employee and to conduct checks required by EU or national legislation on employment.
Critical Data	There is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.
Cyclic Redundancy Check	Often abbreviated to CRC, a mathematical algorithm applied to the digital expression of data providing a level of assurance against loss or alteration of data.
Data Checking	The term is used to capture the verification and/or validation activities performed on aeronautical data and information.
Data Item	A single attribute of a complete data set, which is allocated a value that defines its current status.
Data Processing	The term is used to capture the generation, calculation, and altering of aeronautical data and information.
Data Origination	The creation of a new data item with its associated value, the modification of the value of an existing data item or the deletion of an existing data item.
Data Originator	An entity responsible for the act of data origination.
Derived Data	Data that is derived from other, existing data.
Design Data	Data that is created to fulfil the needs of unique identification of a data item or feature.
Essential Data	There is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.
Integrated Aeronautical Information Package	Abbreviated to IAIP, is an information packages comprising the following elements: • Aeronautical Information Publications (AIPs), including amendment service; • AIP supplements; • NOTAM and Pre-flight Information Bulletins (PIBs); • Aeronautical Information Circulars (AICs); and, • Checklists and lists of valid NOTAMs.
Key Stakeholder Groups	Groups of stakeholders who are directly related to the issue being addressed, e.g. users of a Work Instruction, designers or implementers of a Work Instruction, quality assurance.
Routine Data	there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.
Process	A sequence of high level steps that have to be followed to carry out a task or tasks. A Process defines what tasks and decisions must be made.
Safety Policy	A statement of an organisation's fundamental approach to achieve acceptable or tolerable safety.
Security Policy	A statement of an organisation's fundamental approach to achieve acceptable security.
Work Instruction	A detailed set of actions undertaken relating to a Process. Work Instructions provide the details of how activities within a Process are carried out. Operations Manuals are part of the generic term Working Instructions.

ANNEX H FUNCTIONAL LEVELS

H.1 Functional Level Components

In summary the Functional Levels represent four basic areas of activity that make up a supplier's organization contributing to the production of aeronautical data and information in the data chain.

Organisation – comprises of the business (commercial) and technical management responsible for the strategic and operational activity.

Assurance – provides internal process and product assurance for elements such as product quality control and Tool qualification.

Data Processing – the 'manufacturing' and transformation process associated with the production of aeronautical data and information at particular stages within the data chain.

Support – activities that underpin the operation of the functional unit in terms of providing support services and administration functions.

H.2 Organisational Chart Context

The model presented in Section 2.7 represented the Functional Levels as a stacked model. When mapped onto a supplier organisation chart the Functional Levels may appear as illustrated in Figure H.1:

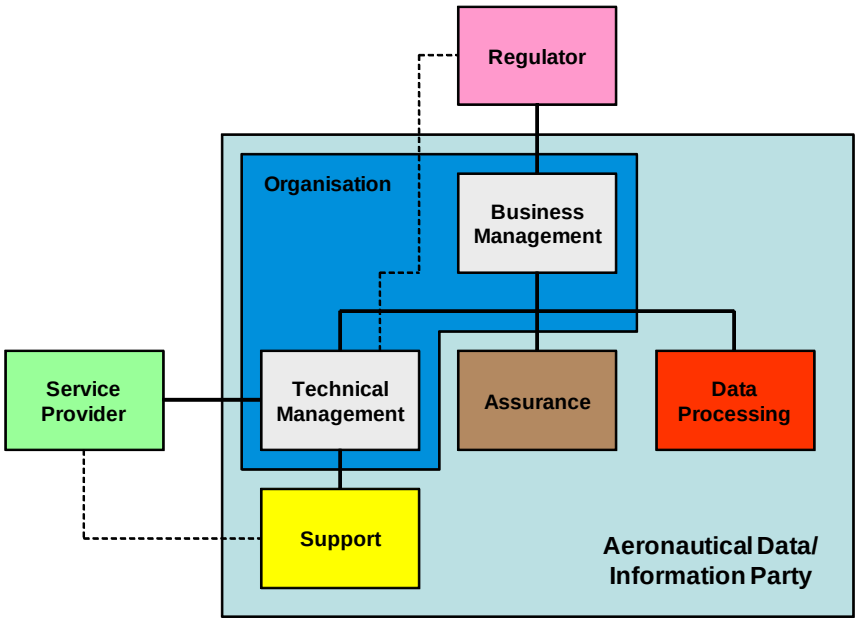

Figure H.1: Outline Organisational Chart with Functional Levels

All the Functional Levels need to be present in one form or another to fully allow the DAL objectives to be met, and other specifications produced to support the ADQ IR.

H.3 External Entities

In Figure F.1 external entities have also been included as they typically make a contribution to the effectiveness with which the party/supplier processes data. They also make a contribution, albeit indirect, to the quality of data produced.

The Regulator is a National Authority vested with the power to ensure that the activities undertaken are compliant to the standards and regulations. The Regulator conducts process and content audits, and provides support on aeronautical data and information standards and regulation.

The service provider is an external entity that provides some form of service facility or support to the data processing operation. For example, a (technical) service provider supplies a Tool or software product used in data processing operations. In reality there are a number of service providers that support the data processing operations at one or more levels.

H.4 Functional Level Activities

H.4.1 Organisation

The Organisation aspects encompass the business functions in addition to strategic technical activities and operational management.

a) The business management functions include:
   i. Strategic planning;
   ii. Supply chain management (formal arrangements / authorised agent management);
   iii. Regulatory management;
   iv. Business continuity arrangements;
   v. Human resource (personnel) management;
   vi. Transition management.

b) The technical management functions are:
   i. Data requirements management (data product specifications);
   ii. Data processes/procedures;
   iii. Technical reviews;
   iv. Technical standards surveillance;
   v. Quality management system;
   vi. Safety management;
   vii. Security management;
   viii. Configuration management;
   ix. Environment / infrastructure policies.

c) The operational management function includes:
   i. Short term (tactical) planning;
   ii. Aeronautical data processing management and supervision;
   iii. Monitoring and reporting;
   iv. Operational problem resolution.

H.4.2 Assurance

The Assurance activities provide support to the Data Processing activities.

a) Supporting assurance activities:

i. Tool qualification and certification;
ii. Internal audits;
iii. Data / processing safety assurance;
iv. Security review activities;
v. Configuration management audits;

b) Data processing assurance activities:
i. Data quality controls / checking / approval;
ii. Data processing quality controls / checking / approval;
iii. Verification and validation.

H.4.3 Data Processing

The Data Processing activities depend on the stage within the Aeronautical Data Chain, but include:

a) Data acquisition/origination;
b) Data co-ordination;
c) Data assessment;
d) Data evaluation;
e) Translation;
f) Cartography;
g) Printing;
h) Distribution;
i) Data error handling.

H.4.4 Support

The Support activities include the following:

a) Documentation management;
b) Configuration management;
c) Office administration;
d) Infrastructure implementation and support;
e) Tools administration;
f) Service / support desk;
g) Problem handling / resolution administration;
h) Backup and archive;
i) Business continuity administration.

ANNEX I MINIMUM CONTENTS OF THE MAIN EVIDENCE MATERIAL

I.1 Overview of the EATMN system

An overview of the EATMN system[22], and the definition of the party's overarching process describing the systems, their constituents and associated procedures involved in the origination, production, storage, handling, processing, transfer and distribution of aeronautical data and aeronautical information.

I.2 Minimum contents of In Service Records

In service records shall be maintained for each component of the EATMN system. In service records shall include as a minimum:

a) Version;
b) Change history;
c) Failures and errors reported, including description and date/time of error;
d) Hours in service.

I.3 Minimum contents of a Work Instruction

A Work Instruction is the detailed set of actions that are undertaken relating to a process. Work Instructions shall include as a minimum:

a) What the actor must do in relation to achieving the requirements of the overarching process;
b) Appropriate checks for the current process in order to detect errors;
c) Instructions for mitigating data errors identified from analysis of other relevant Work Instructions and tools.

[22] Annex I of EC Reg. No 552/2004 subdivides EATMN into eight systems. In the context of the DAL Specification, EATMN system refers to Annex I, item 7 *Systems and procedures for aeronautical information services.*

ANNEX J AMENDMENTS TO SPECIFICATION

Amendments applied in comparison to Edition 1.0.

DAL chapter	page	Change proposal	Reason, Justification
General	all	Revised document configuration pages incl. headers and footers	-
General	11, 25, 29, 30, 55, 64, 76	Changed all ISO 9001:2008 by removing year and by also inserting a footnote on page 11	New ISO QMS Standard
4.1.4.1	24-28	Evidence: Removed EV-010, EV-040 to 060	Rationalisation on reporting/documentation requirements
4.1.4.2.1	26	Removed PRC-040	Part of DO Spec
4.1.4.2.1	27, 28	Data Processing Assurance: Removed objectives PRC-090 to 150.	Due to the recently published industry standard ED76A to avoid inconsistencies and duplication
4.1.4.2.2	28	Removed text reference to Annex J	Annex removed since it is assumed that all parties implemented QMS
4.1.4.2.3	29	Removed text reference to Annex J	ditto
4.1.4.2.4	29	Removed text reference to Annex J	ditto
4.1.4.2.5	29	Removed text reference to Annex J	ditto
4.1.4.2.6	29	Removed text reference to Annex J	ditto
4.3.4.1	34	Removed DE-010 and 020	Considered not required anymore
4.3.4.1	34	Minor text clarifications to DE-030	Clarify text/meaning
4.3.4.1	35	Minor text clarifications to DE-100	Clarify text/meaning
4.3.4.3	35	Footnote #15 replaced with reference to ED76A	Due to the recently published industry standard ED76A to avoid inconsistencies and duplication.
4.3.4.3	36	DE-190 added text to clearly say: “in case of critical data”. Remove DE-150 to 170 and 200-220 and removed related footnotes.	Clarify text/meaning Rationalisation of objectives
4.4.6.3	41	Removed text reference to Annex J	Annex removed since it is assumed that all parties implemented QMS
4.4.6.4	41	Removed text reference to Annex J	ditto
4.5.4.4	45	Removed text reference to Annex J Moved STC-010 into section 4.5.4.5 and added there art 7(4) into lead text. Removed section 4.5.4.4 in full.	ditto Joined two previous sections into one Clarified text/meaning
4.6.3	47-48	Removed all text and insert reference to ED76A, chapter 2.4.5 and App D.	Due to the recently published industry standard ED76A to remove inconsistencies and duplication.
4.6.4.1.1	48	Removed text reference to Annex J	Annex removed since it is assumed that all parties implemented QMS
4.6.4.2.1 - 4.6.4.5	49-52	Removed all objectives TS-020 to TS-250.	Due to the recently published industry standard ED76A to remove inconsistencies and duplication.
4.7.4.1	54	Data Transmission Protection: Removed DTP-010, 020, 050, 060.	Objectives duplicated text from ADQ provisions
4.8.1.4	56	Removed text reference to Annex J	Annex removed since it is assumed that all parties implemented QMS
4.8.2.4.1	57	Removed text reference to Annex J	ditto
4.8.2.4.1	58	Removed SM-020	Contradicted ADQ provisions

4.8.2.4.4	58	Removed text reference to Annex J	Annex removed since it is assumed that all parties implemented QMS
4.8.3.4	60	Removed CM-020	Contradicted ADQ provisions
Annex A	64	Changed date and edition	Clarify text/meaning
Annex B.1	65-70	Revised based on agreed changes	Consequential revision; retaining all objective numbers but clearly indicating those removed.
Annex B.2	70-71	Removed in full	Removed since it is assumed that all parties implemented QMS
Annex C	72, 73	Revised based on agreed changes	Consistency with latest changes
Annex D	74	Revised Spec update procedure	Updated
Annex E	75-76	Revised Reference documents including the references used in relevant sections in doc body. - added ADQ as amended… - removed some references - added 2017/373 - removed unused CHAIN documents- changed DO Spec Ed. - changed eAIP Spec Ed. - changed DQR Spec Ed. - added AIX Spec - added ADQ Guide- revised ED-76 to 76A - revised ED-99 to Ed D - added ED-215 - editorials	Consistency with recent changes in existing or new/additional Reference documents
Annex I	82-84	Streamlined the documentation requirements by removing: • parts of I.1 (b-f); but redefined header for EATMN systems • I.2 • I.5 • I.6 • I.7 • I.8	Rationalisation on reporting/documentation requirements
Annex J	85-90	Removed Annex J content linked with parties without QMS incl. all relevant sections in body of Spec	Annex removed since it is assumed that all parties implemented QMS
Annex J	86, 87	Redefined Annex J to provide the list Spec Amendments listing main changes from Spec Ed. 1.0 to 1.1.	New to communicate latest main amendments

- End of Document -

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