

	<p style="text-align: center;">TANZANIA CIVIL AVIATION AUTHORITY DIRECTORATE OF SAFETY REGULATIONS AIR NAVIGATION INSPECTORATE</p>	Revision: 0 Advisory Circular
Document No: TCAA/QSP/SR/AC/ANI - 49	Title: Guidance on verification and validation of Aeronautical data and aeronautical information.	Page 1 of 9

1. PURPOSE

- 1.1. This Advisory Circular (AC) provides information and guidance on the establishment and implementation of verification and validation processes for aeronautical data and aeronautical information used in the provision of aeronautical information products.

2. SCOPE

This guidance applies to all personnel involved in the origination, processing, storage, distribution, and publication of aeronautical data within the AIM domain, including:

- 2.1. AIS/AIM units
- 2.2. Other ANSPs
- 2.3. Airport operators
- 2.4. Data originators and surveyors
- 2.5. Regulators

3. REFERENCES

- 3.1. The verification and validation processes of Aeronautical data and aeronautical information shall be carried out in compliance with the provisions of the following documents:
- 3.1.1. Civil Aviation (Aeronautical Information Services) Regulations, 2025
 - 3.1.2. Civil Aviation (Aeronautical Charts) Regulations 2017
 - 3.1.3. ICAO Doc 10066 – PANS AIM
 - 3.1.4. ICAO Doc 8697 – Aeronautical Chart Manual
 - 3.1.5. ICAO Doc 9839 – Manual on the Quality Management System for Aeronautical Information Services
 - 3.1.6. ICAO Doc 8126 – AIS Manual
 - 3.1.7. ICAO Doc 9674 – World Geodetic System – 1984 (WGS-84) Manual

Note: Action must be taken to ensure that latest editions of the applicable reference documents are used in the verification and validation processes of Aeronautical data and aeronautical information.

4. DEFINITIONS:

Aeronautical data. A representation of aeronautical facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing.

Aeronautical information. Information resulting from the assembly, analysis and formatting of aeronautical data.

Data Originator: an entity (organization or individual) responsible for the generation, collection, and initial validation of aeronautical data before it is submitted to an AIS Provider. Examples include ATS, Airport Authorities, SAR Providers, CNS, MET Providers, and other entities that disseminate information impacting civil aviation.

Validation. Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled.

Verification. Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled.

5. GUIDANCE AND PROCEDURES

5.1. GENERAL

- 5.1.1. Regulation 13(2) of the Civil Aviation (Aeronautical Information Services) Regulations 2017 require the Aeronautical Information Service Provider (AISP) to establish validation and verification procedures which ensure that upon receipt of aeronautical data and aeronautical information, quality requirements are met.
- 5.1.2. The establishment of verification and validation procedures as part of the processing of aeronautical data into aeronautical products should ensure that the aeronautical data and aeronautical information submitted meets the data quality requirements specified in The Civil Aviation (Aeronautical Information Services) Regulations, 2017.
- 5.1.3. The procedures for verification and validation should be documented in the quality management system (QMS) manual and all verification and validation activities should be logged in the metadata for traceability.
- 5.1.4. The application of the verification and validation procedures will depend on the integrity classification of the data. For example, critical data elements require a more rigorous application of verification and validation than essential data, whereas routine data requires the least rigorous. If data elements of different integrity classification levels are processed together (e.g. routine data is processed together with essential data), then the higher integrity level should be used for selecting the appropriate verification or validation procedure, unless a more rigorous verification or validation is applied to the more critical data.
- 5.1.5. Verification and validation activities do not generate data quality, but confirms that quality requirements are met and maintained, thereby ensuring the integrity of the data. Since the quality of the data is established at the beginning of the data chain, i.e. at origination, verification and validation procedures should be applied at the beginning and continue throughout all subsequent stages of the data chain.
- 5.1.6. Good communication between the data originator and the AIS is essential. With the required data and its quality specified in the formal arrangement, the originator is responsible for providing data according to the specified requirements and needs to set-up data processes and tools accordingly. The originator is also responsible for verifying and validating the data and subsequently transfers it together with the metadata to the AIS, as specified in the formal agreement. The AIS will receive the data and apply its

own verification and validation procedures. Thus, the AIS complements, rather than simply duplicates, the quality assurance activities of the data originator.

5.2. VERIFICATION

- 5.2.1. Verifying all aeronautical data and aeronautical information, will ensure that the output of the applied processes or actions still conforms to the specified data quality requirements without introducing errors.
- 5.2.2. Verification activities may include:
 - a) comparison processes in which data and information are compared with an independent source;
 - b) feedback processes in which data and information are compared between their input and output state;
 - c) processing through multiple independent and different systems, comparing the output of each; this includes performing alternative calculations; and
 - d) processes in which data and information are compared to the originator's request.
- 5.2.3. Verification will also ensure that aeronautical data and aeronautical information has not been corrupted during a transfer.
- 5.2.4. Digital data error detection techniques that are employed should be based on the use of systematic cycling codes and include the use of hash functions and cyclic redundancy check (CRC). Another technique involves transferring the data back to the originator prior to publication and thereby permitting an external comparison between the output and the input.
- 5.2.5. Whenever data is entered manually, the data must be verified to ensure that no errors have been introduced. In this case, the verification procedure has to be commensurate with the integrity classification of the data. Assuming a human error rate of 10^{-3} , the following verification procedures should be applied:
 - a) Routine data requires single data entry that is checked at least once;
 - b) Essential data requires the data entry to be independently checked at least once; and
 - c) Critical data requires the data entry to be independently checked twice.
- 5.2.6. Alternatively, for critical data elements, a verification technique of "blind re-key" may be applied, meaning that a data entry has to be made twice by different individuals with a subsequent comparison check by the automated AIM system.
- 5.2.7. Whenever geographical coordinates must be transformed, the correct application of the transformation formula should be verified using one of the following techniques:
 - a) reverse transformation of the output and comparison with the original coordinates;
 - b) independent calculations using another application or a recognized web-service of a geodetic institute; or
 - c) manual calculation.
- 5.2.8. When formatting aeronautical data, the correct application of the data representation rules must be verified. In this case, the verification technique may be to conduct a visual check of the output.
- 5.2.9. Whenever one or more changes need to be made to a data product, e.g. an AIP Amendment, all the

changes must be verified. A verification technique can be to have the originator check the product, or by comparing the changes with the originators' original data submission.

- 5.2.10. A data element is often portrayed in different data products or in different parts of a particular product (for example, the frequency of a navigational aid is contained in a data set as well as mentioned in different sections of the AIP and displayed on multiple charts). Verification procedures must be consistently applied across a range of different data products.
- 5.2.11. It is therefore advisable that different data products are generated from a single centralized database with an automated AIM system to ensure consistency across all products. Verification is key to ensuring data quality. All systems and phases for processing aeronautical data should be designed in a way that each activity, whether manual or automated, is adequately verified and logged using metadata. Whenever errors are detected during the verification procedure, these errors must be recorded and corrected before proceeding to the next phase.

5.3. VALIDATION

- 5.3.1. Validating aeronautical data and aeronautical information confirms and provides assurance that the quality requirements for the intended use are fulfilled. The users of the data rely on the validation performed by the AIS. Data should be validated as early as possible in the data chain. The sooner any non-compliance with the required data quality is discovered, the less costly it is to correct the errors. Any errors detected by the validation activity must be logged and corrected before continuing the processing.

- 5.3.2. Validation activities may include:

- a) application processes in which data and information are tested;
- b) processes in which data and information are compared between two different outputs; and
- c) processes in which data and information are compared to an expected range, value or other business rules.

- 5.3.3. Types of validation

Two examples of complementary types of validation activities are:

- a) validation based on metadata; and
- b) plausibility check of the data.

- 5.3.3.1. Validation based on metadata

Metadata produced by the data originator should be a source of information for the AIS when validating the data. When analyzing the incoming data for its fitness for use, the service provider shall depend on the verification and validation activities done by the originator. The results of these activities are recorded in the metadata. To validate the data, the service provider should check the metadata received from the originator asking the following questions:

- i) Is the data coming from an authoritative source (i.e. is the originator of the data on the list of authorized originators)?
- ii) Is the metadata complete and are the accompanying documents unambiguous and comprehensible?
- iii) Have all applicable quality requirements, as specified in the formal arrangement been met?

5.3.3.2. Plausibility checks of the data

In addition to validating the data based on the metadata, the service provider should apply other methods as well, namely:

- i) Geographical coordinates can be validated by visualization in a geographic information system, Topographic maps, orthophotos or satellite maps may serve as the geographic reference to compare the data against;
- ii) Distances and bearings can be checked by recalculating them from geographical coordinates (e.g. route-segments or waypoints);
- iii) Declared distances can be checked with other runway data such as runway end coordinates, threshold coordinates, runway length and the dimensions of stopways or clearways; and
- iv) Obstacle data can be checked against digital terrain data in a 3D-viewer, e.g. Google Earth. Thus, erroneous obstacle data can appear to be either embedded within the terrain or floating above it.

5.3.4. Validation with data from neighboring States

In some cases, the same aeronautical data or information is contained in the aeronautical information products and services of two or more States (e.g. common airspace boundaries, routes, waypoints, border points etc.). In such a situation, the United Republic of Tanzania AIS Provider should establish a mechanism to ensure consistency of the aeronautical data that is common with the other State(s). The AIS of the State originating a change that may impact aeronautical data that is common to two or more States should inform the neighboring AIS to avoid inconsistencies. If data inconsistencies exist at the publication target date, then publication should be postponed. However, if the data has already been distributed according to the Aeronautical Information Regulation and Control (AIRAC) system, then corrections must be published by NOTAM.

5.4. ASSEMBLING

5.4.1. Data assembled from different originators should be validated for consistency, for example:

- i) airspace changes should not be in conflict with neighboring airspaces;
- ii) new routes should fit into the existing route network;
- iii) new or modified instrument flight procedures should connect to the existing route network; and
- iv) runway thresholds must be consistent with modified instrument approach procedures.

5.4.2. Once validated, data collected from the different originators (e.g. aerodrome authority, procedure designers) should be assembled into a database which then becomes the authoritative source for all aeronautical information products and services

5.4.3. Automation systems implemented for processing aeronautical data and aeronautical information should ensure traceability of the performed actions.

6. INSTRUCTIONS FOR VERIFICATION AND VALIDATION OF AERONAUTICAL DATA AND AERONAUTICAL INFORMATION

6.1. Detailed Instructions for the Verification Checklist

S/N	Description	Instruction
1	Data received from authorized originator.	Confirm that the data was received from a source that is authorized to provide that type of information (e.g., airport authority for runway data, airspace authority for airspace information). Check against a list of authorized data originators.
2	Data format and units correct.	Verify that the data is in the required format (e.g., ICAO format) and that the units of measurement are correct (e.g., meters, feet, degrees). Refer to relevant standards and specifications.
3	Data completeness checked.	Ensure that all required data elements are present and that no data is missing. Compare against a data completeness checklist or specification.
4	Data accuracy checked against source.	Compare the data against the original source document or database to verify its accuracy. Pay close attention to numerical values, coordinates, and textual descriptions.
5	Data processing steps documented.	Confirm that all data processing steps (e.g., data conversion, transformation, aggregation) are documented in a clear and understandable manner.
6	Changes to data logged and traceable.	Ensure that any changes made to the data during processing are logged and traceable back to the original source. This includes who made the change, when it was made, and why.
7	Data published matches source data.	Verify that the data published in aeronautical information products (e.g., charts, NOTAMs, AIP) matches the original source data.
8	All required information included.	Ensure that all information required by regulations and standards is included in the published products.
9	No unauthorized changes made.	Confirm that no unauthorized changes have been made to the data during processing or publication.
10	Tools/systems used are validated.	Verify that all software and systems used for data handling and processing have been validated to ensure their accuracy and reliability.

Organization Logo		Name of Organization Name of Department			Revision: #
Document ID:	Title: Verification Checklist			Date:
Data/Information/Type:					
S/N	Description	Yes	No	N/A	Remarks
1	Data received from authorized originator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Data format and units correct	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Data completeness checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Data accuracy checked against source	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Data processing steps documented	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	Changes to data logged and traceable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	Data published matches source data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	All required information included	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	No unauthorized changes made	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10	Tools/systems used are validated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Verified by:	Name:	
	Title:	
	Date:	
	Signature:	

Authorized by:	Name:	
	Title:	
	Date:	
	Signature:	

6.2. Detailed Instructions for the Validation Checklist

S/N	Description	Instruction
1	Data meets user operational requirements	Assess whether the data meets the operational requirements of pilots, air traffic controllers, and other users. Consider factors such as accuracy, timeliness, and usability. This may involve consulting with user representatives or conducting operational simulations.
2	Data is timely and relevant	Ensure that the data is up-to-date and relevant to the current operational environment. Consider the frequency of updates and the impact of outdated information
3	Data integrity level appropriate	Verify that the data integrity level (e.g., routine, essential, critical) is appropriate for the intended use of the data. Refer to the Civil Aviation (Aeronautical Information Service) Regulations and PANS-AIM for guidance on data integrity levels.
4	Data integrity maintained throughout chain.	Ensure that data integrity is maintained throughout the entire data chain, from origination to publication. This includes protecting the data from unauthorized access, modification, or deletion.
5	User feedback collected and analysed.	Confirm that a system is in place for collecting and analysing user feedback on aeronautical information products and services. This may involve surveys, interviews, or incident reporting.
6	Periodic reviews/audits conducted.	Ensure that periodic reviews and audits are conducted to assess the effectiveness of the AIS/AIM unit's quality management system and to identify areas for improvement.
7	V&V activities documented	Verify that all verification and validation activities are documented in a clear and comprehensive manner.
8	Personnel trained and competent	Ensure that all personnel involved in verification and validation are adequately trained and competent to perform their assigned tasks.
9	Continuous improvement actions taken.	Confirm that continuous improvement actions are taken based on audit findings, user feedback, and changes in regulations and standards.

Organization Logo		Name of Organization Name of Department			Revision: #
Document ID:	Title: Validation Checklist			Date:	
Data/Information/Type:					
S/N	Description	Yes	No	N/A	Remarks
1	Data meets user operational requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Data is timely and relevant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Data integrity level appropriate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Data integrity maintained throughout chain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	User feedback collected and analysed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	Periodic reviews/audits conducted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	Verification and Validation activities documented	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	Personnel trained and competent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	Continuous improvement actions taken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10	Tools/systems used are validated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Validated by:	Name:	
	Title:	
	Date:	
	Signature:	

Authorized by:	Name:	
	Title:	
	Date:	
	Signature:	

Note: *Adherence to these instructions will help ensure that the Verification and Validation Checklists are completed accurately and consistently, thereby supporting the safety and efficiency of air navigation services.*



Tanzania Civil Aviation Authority