



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

GUIDELINES FOR VERIFICATION & VALIDATION OF AERODROME MAPPING DATABASES (AMDB) AERODROME SURFACE ROUTING NETWORKS (ASRN) FOR ROUTING APPLICATIONS

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FOREWORD

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EXECUTIVE SUMMARY

This is a guidance document on the concepts, methods, and criteria for verification and validation of an Aerodrome Surface Routing Network (ASRN). The ASRN of an Aerodrome Mapping Database (AMDB) is a connected network defined by node and edge features that support taxi routing functions (e.g. D-Taxi) and other applications (e.g. the ones developed within SESAR and NextGen). Such applications contribute to situational awareness as well as safety, capacity, and efficiency of operations.

The connected network introduced by the ASRN can support the intended applications of multiple users (both on the ground and onboard) in collaborative ways. In order to ensure the consistency of the ASRN for multiple users, it is necessary to provide guidance on verification and validation applied to the ASRN. This document has been written with the assumption that if all users are using verified and validated ASRNs, greater interoperability can be achieved, along with new functions, capabilities, and operational improvements.

The information contained in this document has been prepared to provide guidance related to the compliance of the ASRN with the rules defined in EUROCAE ED-99C / RTCA DO-272C and the compliance with specific application requirements (e.g. data quality or display requirements). The guidelines presented are not all-inclusive, but represent a framework for creating and using verification and validation processes applied to the ASRN. The intended users of this document include aerodrome operators, air navigation service providers, airframe manufacturers, Air Traffic Control (ATC), Air Traffic Management (ATM)/ground system manufacturers, avionics manufacturers, certification authorities, data suppliers, regulators, and Research and Development (R&D) organizations.

The document is organized as follows:

- Section 1 provides scope and background information with respect to the ASRN and the operational context, and lists the main stakeholders that may use the document in their processes
- Section 2 states general considerations about verification and validation
- Section 3 describes acceptance criteria for verification and validation
- Section 4 provides some methods for the verification and validation of ASRNs
- Appendix A includes operational perspectives on ASRN verification and validation
- Appendix B presents an example of a potential operational implementation (D-Taxi application)
- Appendix C explains the use of some ASRN Key Performance Areas, Key Performance Indicators, and Metrics
- Appendix D is a glossary of relevant terms
- Appendix E lists abbreviations and acronyms
- Appendix F lists the membership of the committee that developed this document

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CHAPTER 1

INTRODUCTION AND SCOPE

1.1 INTRODUCTION

This document provides guidelines for the verification and validation of Aerodrome Surface Routing Networks (ASRN) in Aerodrome Mapping Databases (AMDB) for routing applications and potentially other applications. Those who develop and/or use an AMDB may use this document to guide their verification and validation process for ASRN. This document does not supersede the existing documents describing processes related to Aeronautical Data, e.g. ED 76 / DO200A, FAA AC 20-153A, or EU 73/2010.

1.2 SCOPE

This document only covers the verification and validation of AMDB ASRN. The verification and validation of other portions of AMDB are covered in section 3.9 of EUROCAE ED-99C / RTCA DO-272C.

The verification and validation process described in this document addresses both the compliance of the ASRN with the rules defined in EUROCAE ED-99C / RTCA DO-272C (e.g. geometry, capture rules, and attribute constraints) and the compliance with the specific application requirements (e.g. data quality or display requirements). It covers general considerations, acceptance criteria, and potential methods.

This document applies to entities involved in the development, revision, and/or use of ASRNs. These entities may be any of the stakeholders (reference Table 1.6-1) involved in ground and onboard application development and use of ASRNs.

It is not the intent of this document to provide a verification and validation process, but rather a framework for creating and using such processes.

1.3 BACKGROUND

The ASRN information can be an integral part of an AMDB. It uses aerodrome data to produce a connected routing network. The network facilitates graphical depiction of a route on the representation of the aerodrome surface to aid in taxi-in and taxi-out operations. The ASRN does not cover taxi operations navigational guidance.

The ASRN as defined in EUROCAE ED-99C / RTCA DO-272C provides connectivity up to the points where taxiways intersect with parking or apron areas but does not extend into those areas.

For example, the nodes in Figure 1-1 labeled 600D, 600L, etc. identify where the ASRN ends at the intersections of taxiway X and parking stands 600D, 600L, etc., but there are no nodes or edges in those parking areas. Similarly, there is a node identifying the transition point between taxiway X and "Maintenance Apron", but no nodes or edges in the apron area. Therefore, the ASRN supports identifying the point where a route can start or end in the maneuvering area given a particular parking area, but does not provide the geographical location of the parking area itself.

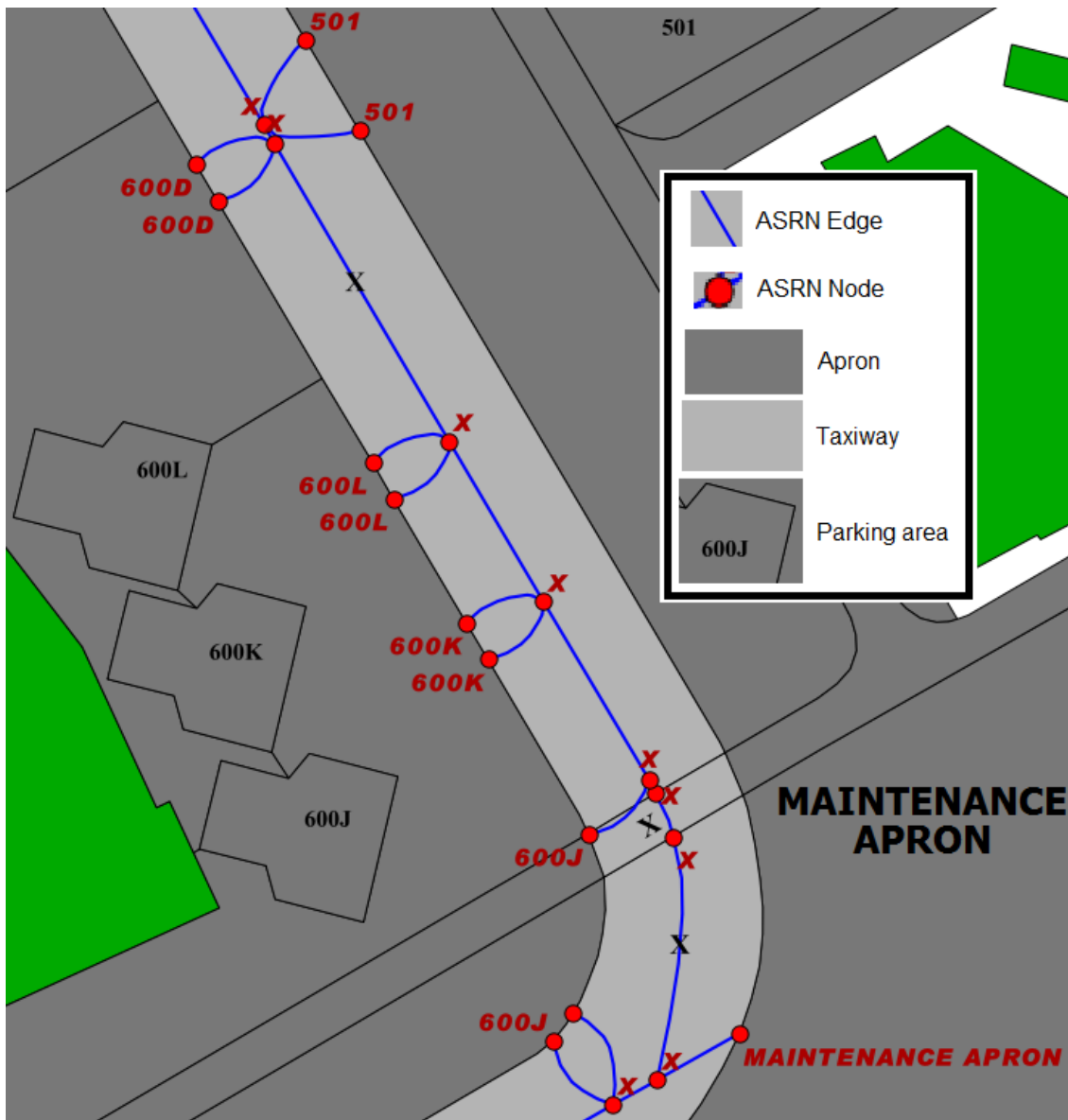


FIGURE 1-1: EXTENT OF ASRN IN MANEUVERING AREA

The ASRN supports applications on both ground and flight deck systems, such as graphical depiction or manual entry of taxi routes. It also supports integrated ground/air operations like data link taxi (D-Taxi). The ASRN can be used to support a graphical representation of the assigned taxi route. EUROCAE ED-99C / RTCA DO-272C states: "The taxi route available to the application typically consists of a start, a destination, and a list of intermediate destinations. However, it cannot be assumed that these points define the complete extent of the route. Thus, a routing algorithm is required to interpret the route definition from textual instructions."

The ASRN by design supports the creation of an unambiguous taxi route, the transmission of taxi routes in a format usable by onboard aircraft applications, and the display of the taxi route on an aerodrome map. In the context of integrated ground/air operations, an important point is that when both ground and aircraft have an AMDB, they are not required to use the same database. Therefore, the information in both databases should come from an Approved Information Source, which is a source that has been officially recognized by its relevant State (refer to section 1.4 and Glossary for a definition of Approved Information Source).

1.4 KEY ASRN TERMINOLOGY

The ASRN is a connected graph defined by nodes and edges. A graph represents a set of vertices (nodes) that are linked together by edges. The vertices are typically an abstract representation of objects; in the case of the ASRN, the nodes represent intersections of taxiways, runways, and apron/parking areas, or other important locations on the aerodrome maneuvering area. The ASRN is a directed graph, since each edge has directionality (although due to the nature of aerodromes, many edges are bi-directional).

There is a difference between verification and validation. Verification involves testing against a defined set of performance measurements or metrics to ensure conformance to the requirements. The process of verification involves checking individual elements against another source or rule set to ensure they meet the requirements (in particular accuracy and integrity). The process of validation focuses on ensuring the intended functional needs of the system are met.

ASRN verification intends to provide evidence that the supporting data features were built as prescribed by the requirements in EUROCAE ED-99C / RTCA DO-272C.

ASRN validation is performed to ensure the ASRN fulfills an intended purpose when placed in the intended environment. To ensure that an ASRN can support the intended applications, it is validated against a set of acceptance criteria. The validation processes vary according to the needs of the individual stakeholder.

In the context of this document, interoperability is the ability of systems and organizations to use their respective ASRN to work in a consistent way within the same aerodrome such that multiple ASRNs produce a consistent result.

In this document, the term Approved Information Source means trusted aerodrome data source. For an integrator, this Approved Information Source should be the State Aeronautical Information Publication (AIP). For the data supplier, the Approved Information Source should be a repository that is declared as a true and accurate representation of the aerodrome at a specific point in time. All users must ensure they use the appropriate Approved Information Source for their need.

1.5 OPERATIONAL CONSIDERATIONS

The following paragraphs provide considerations to understand the context of verification and validation of ASRN data. This section does not address operational considerations of applications needing ASRN data.

- Creation of any instantiation of an ASRN requires using feature polygons for the development of nodes. The feature polygons supporting the AMDB definition of runways and taxiways for independently developed AMDBs for a given aerodrome are likely to be different. For example, the number and size of polygons used to describe a given runway or taxiway at a given aerodrome is likely to vary depending on the developer and their development processes. The use of Approved Information Source aerodrome data (as included in the AIP) can ensure some, but not necessarily all, levels of interoperability between AMDBs. Additional verification and validation should be used to ensure interoperability of AMDB data not derived from the AIP such as polygon geometries.
- Terminal ground ATC systems can rely on AMDBs developed either by a data supplier or by the ATC itself. Data suppliers developing the ASRN for ground applications must ensure development of the ASRN based on Approved Information Source aerodrome data. At a minimum, the ground application ASRN must be capable of reproducing any routing descriptions in the specific aerodrome ATC Standard Operating Procedures (SOP) document.
- There will be multiple onboard application vendors for aerodrome maps. Since there are multiple application vendors, there are likely to be multiple application vendor-specific implementations of an onboard ASRN for any given aerodrome. For integrated services (e.g. D-Taxi), interoperability of ASRNs is critical. This requires validating the routings the ground ATC applications generate and the resulting routings the aircraft receives are correctly understood by the onboard applications and properly presented on the flight deck display(s).

- Updates to the specific aerodrome ANSP SOP document are assumed to be part of the Approved Information Source documentation and to follow ICAO SARPS.
- Accommodation must be made in policy and process for mixed environment operations, with and without ASRN.

Operational perspectives on ASRN verification and validation for various stakeholders are provided in Appendix A.

1.6

STAKEHOLDERS

The following table provides insight into how the different ASRN stakeholders may use the document in their processes. An asterisk against a stakeholder indicates a role in the data chain (see EUROCAE ED-76 / RTCA DO-200A).

TABLE 1.6-1: STAKEHOLDERS AND THE INTENDED USES OF THE DOCUMENT

Stakeholder	Intended use of this document	Comments
Aerodrome Operators*	To ensure that any taxi routings that are used are correctly implemented.	This would focus on restricted use as well as standard use.
Air Navigation Service Providers*	To ensure that any published source materials defining taxi routings are accommodated.	
Airframe Manufacturers*	Use it for system integration and concept of operations validation. Reference in system requirements documentation.	
Air Traffic Control	To ensure that any taxi routings that are used are correctly implemented.	This would focus on the interoperability aspects of systems from different applications, especially between aircraft and ground systems.
ATM/Ground System Manufacturers*	Reference in requirements documentation.	Consider this guidance material to ensure that verification and validation plans have chosen the most effective means of ensuring the intended functional use, and for system and software testing.
Avionics Manufacturers*	Reference in requirements documentation.	Consider this guidance material to ensure that verification and validation plans have chosen the most effective means of ensuring the intended functional use, and for system and software testing.
Certification Authorities	Develop policy guidance.	Ensure that when used, the verification and validation process has been followed.
Data Suppliers*	Ensure consistency with user requirements.	As required by users and airframe manufacturers. Aid in the development of verification and validation processes.