

Review of Waypoint Database Management in the Cartography Unit of the Aeronautical Information Services

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Article Info	ABSTRACT
<p>Article History: Submitted: July 13, 2025 Revised : August 1, 2025 Accepted : August 9, 2025</p>	<p>This study analyzes the management of waypoint databases in the Cartography Unit of the Aeronautical Information Center to evaluate data accuracy, integrity, and compliance with national and international aviation standards. Using a qualitative descriptive approach through document review, field observation, and semi-structured interviews, the research identified significant weaknesses in the current system, including the absence of formal Standard Operating Procedures (SOPs), lack of independent verification, and unclear accountability in database management. These shortcomings have resulted in inconsistencies in critical navigation data, such as discrepancies in waypoint coordinates and naming across aeronautical charts, which may directly impact flight safety and operational efficiency. A gap analysis comparing existing practices with ICAO Doc 8126 and Indonesian Regulation PM 09/2023 confirmed that the current workflow does not meet the required standards of validation and quality assurance. The study recommends the development of formal SOPs, the appointment of a designated database manager, and the implementation of independent verification mechanisms to enhance data reliability. By addressing these issues, this research contributes to strengthening aeronautical data management practices in Indonesia and supports the provision of safer and more efficient flight operations</p>
<p>Keywords: <i>aeronautical information services, data integrity, waypoint database, flight safety, standard operating procedure</i></p>	

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INTRODUCTION

Accurate and consistent aeronautical information is very important for flight safety and safe operations. Aeronautical Information Services (AIS) from the International Civil Aviation Organization (ICAO) are responsible for providing this information on time and in the correct format [1]. In Indonesia, this task is handled by the Aeronautical Information Center under Perum LPPNPI, which produces and maintains aeronautical charts and publications.

One important data set used in the Cartography Unit is the waypoint database. Waypoints are fixed geographic points that are used for flight navigation routes and procedures [2]. These waypoints are very important for chart making, flight planning, and air traffic management. If the data in this database is inconsistent or inaccurate, such as different coordinates or names for the same waypoint, it can cause confusion and increase risks to flight safety [3]

Observation during this research found that there are inconsistencies in waypoint data on some aeronautical charts. For example, the same waypoint may have different coordinates on two different charts. This problem shows that there are still weaknesses in the database management system. This condition also does not meet the standards from ICAO Doc 8126, which states that waypoint data is “critical data” and must be checked carefully by more than one person [4]

Some previous studies discuss general quality control for AIS [5], but research that focuses on waypoint database management in Indonesia is still very limited. This study aims to analyze the workflow of waypoint database management in the Cartography Unit, find the main causes of inconsistency, and give recommendations that match national regulations (PM 09/2023) and international standards. The new point of this research is the use of gap analysis to compare current practice with regulations, and give practical solutions to improve data quality for safer aeronautical information services.

METHODS

This study used a qualitative descriptive method to examine the management of waypoint databases at the Cartography Unit of the Aeronautical Information Center. The qualitative approach was chosen because this research focused on understanding processes and organizational practices rather than statistical hypothesis testing [6]. Data were collected through document review, direct observation, and semi-structured interviews. Document review was carried out by examining aeronautical charts, waypoint databases, and related Standard Operating Procedures (SOP) to identify how data are organized and updated. Observations were conducted at the Cartography Unit to see the actual workflow of updating and verifying waypoint data. In addition, semi-structured interviews with staff and supervisors were conducted to gain insights about data accuracy, coordination between divisions, and the application of safety and security procedures [7].

To ensure data credibility, triangulation was applied by comparing findings from documents, observations, and interviews. Data analysis used an inductive process, starting with data reduction, grouping similar findings, and interpreting patterns to identify major themes about efficiency, safety, and compliance. The results of this analysis were compared with international standards from ICAO and national regulations to identify gaps and propose recommendations for improvement [1].

RESULT AND DISCUSSION

The results of this study show that the management of the waypoint database in the Cartography Unit is still carried out manually and without clear procedural guidelines. Observations revealed that most database updates are done by individual staff members without a formal Standard Operating Procedure (SOP). Furthermore, there is no structured process for independent verification. These practices increase the likelihood of inconsistency in critical navigation data such as waypoint coordinates and names.

During the document analysis, several inconsistencies were found between different sources of aeronautical data. Some waypoints appeared with different coordinates in various documents, while

others were missing in one chart but listed in another. These inconsistencies can compromise the quality and accuracy of navigation charts, which are essential for safe flight planning. Table 1 presents a few examples of these inconsistencies.

Table 1 Inconsistency in Waypoint Coordinate Data

Waypoint	Coordinate	Source
GUROL	09°24'55"S 116°13'19"E	WADD AD 2.24-9A8 AIRAC AIP AMDT 141
	08°58'26"S 116°05'29"E	WADD AD 2.24-9B7 AIRAC AIP AMDT 141
LL636	01°14'25"S 117°18'32"E	WALK AD 2.24-7B4 AIRAC AIP AMDT 154
	01°20'34"S 117°18'35"E	WALL AD 2.24-9B6 AIRAC AIP AMDT 154
LK442	02°01'56"S 116°35'52"E	WALK AD 2.24-9A5 AIRAC AIP AMDT 154
	01°59'06"S 116°36'24"E	WALL AD 2.24-9A5 AIRAC AIP AMDT 154

These findings reflect weaknesses in the current data validation process. Interviews with staff confirmed that database updates are handled by only one person, with no independent cross-checking in place. This contradicts ICAO’s recommendation that critical data, such as waypoint information, must be verified independently by a second qualified individual to ensure accuracy [8]. In addition, no official personnel have been formally assigned to be in charge of the database, resulting in unclear responsibility and inconsistent accountability. Another concern is the lack of synchronization between the update schedule of the database and the Aeronautical Information Publication (AIP) amendment cycle, which increases the risk of outdated information being used during chart development.

To better understand the gap between current practices and applicable standards, a gap analysis was conducted by comparing observed conditions with ICAO Doc 8126 and national regulation PM 09/2023. This analysis revealed three main shortcomings. First, the Cartography Unit lacks a formal SOP that clearly defines the procedures for updating and verifying waypoint data. Second, there is no independent verification system in place; the verification process is carried out by a single individual, which does not fulfill the requirement for dual-person verification. Third, there is no formally designated database manager or person in charge (PIC), which creates ambiguity regarding roles and responsibilities in maintaining data accuracy. These three issues reflect a lack of workflow structure, inadequate quality assurance, and weak accountability. Table 2 summarizes these findings.

Table 2 Gap Analysis

Aspect	Current Condition	Gap	Reference
SOP for Database Waypoint	There is no formal SOP	No documented workflow	PM 09 2023 [2]
Independent Verification	No officially assigned personnel responsible for managing the database.	No Independent check process	ICAO DOC 8126 [1]
Accountability	Checked by single staff member only	Responsibilities undefined	PM 09 2023 [2]

These findings align with research by Syavitri et al. [5], who emphasized the importance of independent quality control in NOTAM publication to reduce errors and ensure data reliability. Mutmainah et al. [9] also demonstrated that gap analysis is a useful tool to evaluate system performance and guide operational improvements. Furthermore, ICAO Annex 15 clearly states that all aeronautical data must be processed through quality assurance mechanisms such as validation, verification, and monitoring [10]. Without these controls, the risk of data inconsistency and operational hazards increases.

To address the problems identified in this study, it is strongly recommended that the Cartography Unit develop a formal SOP for waypoint database management, assign an official PIC to oversee data processes, and implement an independent verification mechanism. These steps would significantly improve data integrity and align current practices with both national and international standards, ultimately supporting safer and more efficient air navigation.

CONCLUSION

This study concludes that the management of waypoint databases in the Cartography Unit remains manual and lacks formal procedures, which does not align with ICAO and national standards. The analysis identified three critical gaps: the absence of a formal Standard Operating Procedure (SOP), the lack of independent verification, and unclear accountability in maintaining data integrity. These shortcomings contribute to inconsistencies in waypoint information, potentially affecting the accuracy of aeronautical charts and the safety of flight operations. To resolve these issues, it is recommended to develop and implement a formal SOP, assign a designated database manager, and establish an independent verification process. These measures will significantly improve data reliability and ensure alignment with both national and international aeronautical information service standards.

ACKNOWLEDGEMENT

The authors wish to extend their deepest gratitude to Allah SWT for His endless blessings and guidance, which enabled the completion of this research. The authors are sincerely thankful to their supervisors, Mr. Togi Adnan Maruli Sinaga and Mr. Gilang Trio Putra, for their valuable guidance, constructive feedback, and continuous encouragement throughout the research process. Special appreciation is given to the Indonesian Aviation Polytechnic Curug for providing the facilities and academic environment that supported this study, and to the staff of the Aeronautical Information Center, particularly the Cartography Unit, for their assistance and cooperation during observations and data collection. The authors also express heartfelt thanks to their families for their prayers, motivation, and unwavering support. It is hoped that this research can contribute positively to improving data management practices and enhancing safety in aviation operations.

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