

An Evaluation of User Feedback Data Management in The Cartography Unit of The Aeronautical Information Center

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Article Info	ABSTRACT
Article History: Submitted: August 10, 2025 Revised: August 15, 2025 Accepted: August 30, 2025	<i>In the aviation industry, ensuring the quality and accuracy of aeronautical data is essential for maintaining the safety, efficiency, and reliability of air navigation. One important mechanism for data quality control is User Feedback (UFB), which contains reports from users regarding potential non-conformities in aeronautical chart products. This study aims to evaluate the UFB data processing workflow in the Cartography Unit of the Aeronautical Information Center and to design a priority classification model to address existing operational gaps. The research employs a qualitative case study approach, using data triangulation through interviews, observations, and document analysis. Data from August 2024 to June 2025 show a backlog of 46 unresolved UFB cases, including 7 classified as critical, 18 as major, and 21 as minor. The current first-in, first-out (FIFO) system lacks a formal priority classification, causing delays, with critical issues requiring an average of 21 days to resolve. To address this, the study proposes a risk-based classification model with Critical, Major, and Minor categories, adapted from ICAO Doc. 8126. Implementation is expected to reduce critical-issue resolution time by up to 50% and enhance overall data quality. The study is limited to chart-related UFB, with future work focusing on integrating the model into automated AIS management systems.</i>
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INTRODUCTION

In the modern aviation industry, the precision, completeness, and reliability of aeronautical data are fundamental to maintaining safety, regularity, and efficiency in air navigation[1]. Aeronautical charts, as core products of the Aeronautical Information Service (AIS), provide essential guidance for pilots, air traffic controllers (ATC), airlines, and other stakeholders in navigating safely within Indonesian airspace[2]. In Indonesia, the Aeronautical Information Center (Pusat Informasi Aeronautika/PIA) under Perum Lembaga Penyelenggara Pelayanan Navigasi Penerbangan Indonesia (LPPNPI) — through its Cartography Unit is mandated to produce, update, and maintain these charts in compliance with the International Civil Aviation Organization (ICAO) standards[3,4].

Maintaining the quality of aeronautical charts is not a one-time task but a continuous process that depends on timely detection and resolution of discrepancies. One of the most important mechanisms in this cycle is User Feedback (UFB) reports submitted by chart users identifying possible non-conformities, ranging from formatting inconsistencies to critical safety-related errors such as incorrect coordinates, misaligned waypoints, or missing procedural data. In many cases, UFB can reveal operational hazards that internal quality checks may overlook, making it a vital safety layer within AIS operations. Feedback classification methods have also been studied in software-oriented contexts [5].

However, within the Cartography Unit, UFB is currently processed using a first-in, first-out (FIFO) sequence, without a formal mechanism to classify reports according to urgency or severity. This approach means that a non-urgent matter can delay the handling of a critical safety issue. In comparison, other AIS environments, such as the United Kingdom's AIS managed by NATS and Eurocontrol's Aeronautical Data Quality (ADQ) framework, employ structured classification systems that categorize issues into severity levels (e.g., Critical, Major, Minor) and assign responsibility to specific personnel from the outset. These systems prioritize safety-impacting reports, integrate classification into their standard operating procedures, and often utilize software-assisted tracking to improve accountability and reduce resolution times.

Although ICAO Doc. 8126 and the Letter of Coordination Agreement (LOCA) between PIA and the Flight Procedure Department stress the importance of prioritization, Standard Operating Procedure (SOP) 033 on Non-Conformity and Corrective Action at PIA does not yet adopt a comprehensive classification system. It lacks early-stage categorization of reports and the clear designation of a Person in Charge (PIC), leading to overlapping responsibilities, inconsistent follow-ups, and persistent backlogs. Data from August 2024 to June 2025 confirm this gap, showing 46 unresolved cases, including 7 critical errors, with critical issues taking an average of 21 days to resolve.

To address these gaps, this study proposes a risk-based priority classification model adapted from ICAO Doc. 8126 but customized to the operational context of the Cartography Unit. Unlike generic or automated classification models used in other sectors[6], this approach is designed specifically for aviation chart data in Indonesia, ensuring compliance with global standards while addressing local workflow realities. The research aims to (1) examine the current UFB processing workflow to identify strengths, weaknesses, and operational constraints, and (2) design a structured classification model that enhances decision-making, reduces delays in handling critical issues, and improves the quality and safety of aeronautical data in the Indonesian AIS environment.

METHODS

This study employed a qualitative case study approach [7,8] to explore and evaluate the workflow for processing User Feedback (UFB) within the Cartography Unit of the Aeronautical Information Center (PIA). The qualitative design was chosen to capture in-depth insights into operational procedures, organizational practices, and the perspectives of personnel directly involved in UFB management. The research process followed a systematic sequence from preparation, data collection, and analysis to the formulation of findings and recommendations.

Research Design

The study was designed as a descriptive qualitative case study[9], focusing on the operational setting of the Cartography Unit. This design was selected for its capacity to examine current practices in detail and assess their alignment with established standards such as ICAO Doc. 8126. The aim was to describe the existing workflow, identify procedural gaps, and propose a practical classification model.

The research activities included literature review, field observation, semi-structured interviews, documentation review, and qualitative data analysis.

Population, Sample, and Sampling Technique

The population consisted of all personnel directly involved in the reception, analysis, and handling of UFB in the Cartography Unit. Using purposive sampling, six participants were selected: one Head of Cartography, two Senior Cartographers, two Operational Staff, and one Quality Control Officer. All participants met the primary criterion of having direct operational experience with UFB processing. This ensured that the perspectives collected reflected both supervisory and operational viewpoints.

Data Collection Techniques

Data were collected through three primary methods observation, interviews, and documentation review applying methodological triangulation[10] to enhance validity.

1. Observation – Conducted during the author's On-the-Job Training (OJT), allowing real-time monitoring of UFB reception, analysis, and resolution. Field notes documented workflow sequences, SOP adherence, and communication patterns.
2. Interviews – Semi-structured interviews were held with all six participants to explore procedures, perceived challenges, and recommendations.
3. Documentation Review – Examined SOP.033, ICAO Doc. 8126, LOCA, and historical UFB records from August 2024 to June 2025.

Triangulation was achieved by systematically cross-checking observations against interview responses and documentation evidence. For example, workflow steps observed in practice were verified against SOP requirements and confirmed through participant statements, ensuring consistency and reliability across sources.

Data Analysis

The Miles and Huberman model was applied: (1) Data Collection; (2) Data Reduction through categorization of key findings; (3) Data Display in tables and narratives to identify patterns; and (4) Conclusion Drawing and Verification by re-checking interpretations against multiple data sources. This iterative process reinforced the internal validity of findings..

Research Location and Duration

The study was conducted at the Cartography Unit of the Aeronautical Information Center, LPPNPI Headquarters, Tangerang, Indonesia. Fieldwork and data analysis were conducted from July 2024 to August 2025. This 14-month period was sufficient to capture seasonal and procedural variations, including peak traffic months and scheduled chart revision cycles, thereby providing a representative view of both routine operations and irregular challenges in UFB handling.

RESULT AND DISCUSSION (STYLE TEMPLATE I. HEADING 1)

A. Research result

The findings were obtained through observation, interviews, and document review. Analysis of UFB data from August 2024 to June 2025 identified **46 unresolved UFB reports**, consisting of **7 critical reports (15.2%)**, **18 major reports (39.1%)**, and **21 minor reports (45.7%)**. Resolution time for critical reports averaged **21 days**, significantly exceeding the ICAO-recommended limit of ≤ 10 days for safety-related issues. Such delays pose residual safety risks, particularly in cases involving incorrect waypoint coordinates.

1. Observation Results

Observations were conducted during the implementation of On-the-Job Training at the Cartography Unit of the Aeronautical Information Center. The observations focused on data processing activities and the availability of standard documents. The UFB handling process follows a first-in, first-out (FIFO) principle without initial classification. This results in minor reports such as typographical errors blocking the processing of critical safety issues. During the observation period, case resolution throughput averaged only 3–4 cases per month, causing the backlog to increase over time. The observation results are summarized in Table 1 below:

Table 1 Summary of Observation Results

Observed components	Findings
UFB Data Processing Workflow (Doc.8126 AIS Manual)	The UFB data handling process is carried out sequentially based on the time sequence of report arrival.
Reference Document (Doc.8126 AIS Manual)	The use of SOP.033 Non-Conformance Procedure and Corrective Action was found, but it did not explain specifically for priority handling of UFB and the time it was carried out.

Based on the observations, the author concludes that the current user feedback (UFB) processing process in the Cartography Unit for handling complaints is still sequential based on the chronological order of arrival of UFB reports. During field observations, the author found that the current handling process is only based on SOP.033, which still lacks a priority classification process at the beginning of UFB report handling. This finding concludes that the current process is not yet effective.

2. Interview Results

Interviews were conducted with all cartographer personnel to obtain an overview of the UFB data processing process and All respondents confirmed the absence of a formal prioritization mechanism, a designated Person in Charge (PIC), or a centralized monitoring dashboard. This leads to suboptimal resource allocation and extended response times for high-impact issues. Summary of interview results regarding UFB data processing in the Cartography Unit, Table 2, below:

Table 2 Conclusion of Interviews with Cartography Personnel

Question	Answer Summary
Is there a classification of data error levels in the SOP related to user feedback data processing?	All personnel interviewed stated that, although there is an SOP.033 that regulates non-conformances and corrective actions, there is currently no official SOP specifically for the user feedback (UFB) priority classification workflow.
Is the current user feedback data processing system optimal?	All personnel interviewed stated that the current system (First-In, First-Out) can functionally resolve all reports, but is considered suboptimal because it does not have a mechanism to differentiate reports based on their level of risk or impact on safety.
In your opinion, what are the obstacles that cause the accumulation of UFB?	All personnel explained that the main obstacle they faced was the lack of established standards or tools for determining priorities, leaving management largely dependent on analyst initiative. This was exacerbated by a high workload, a disjointed monitoring process, and the absence of a designated person responsible for the UFB reports submitted to the Cartography Unit.
In your opinion, is it necessary to develop or	All personnel confirmed that developing a priority classification system was essential. They stated that a visual tool like a dashboard

update the system at this time?	would be extremely helpful in quickly identifying critical issues and allocating resources more effectively to ensure safety.
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From the results of the interviews, the author concluded that all sources confirmed that although there is SOP.033 which regulates the procedure for non-conformity and corrective actions, there is currently no specific procedure for processing the priority classification of UFB. Personnel also stated that the current system, although functionally able to complete reports, is considered suboptimal because it does not have a mechanism to differentiate reports based on their risk level. In the Cartography Unit there is also no PIC who is fully responsible for UFB reports received by the Cartography Unit.

3. Documentation Results

Review of ICAO Doc. 8126 and the Letter of Coordination Agreement (LOCA) revealed that the “Critical” category includes data that can directly jeopardize safety, such as elevation, coordinates, and flight paths. However, SOP.033 has not adopted this framework, resulting in no initial filtering of safety-critical issues from minor discrepancies. Trend data show that the proportion of critical reports has remained relatively stable at around 15% each semester, indicating that the problem is systemic rather than seasonal. This framework is very useful for understanding the impact of each non-conformity found. The document explains the categories of data errors as follows:

a. Errorcriticalimplies that the error directly endangers the safety of air navigation, for example:

- 1) Errors can compromise the aircraft's safe distance from terrain, for example an incorrect instrument approach;
- 2) Errors in navigation or route information, for example wrong lanes; and
- 3) Errors in the depiction or publication of airspace information, for example incorrect vertical boundaries;

b. Errormajor implies that the information intended for air communications or navigation is missing, confusing, or difficult to interpret, for example an incorrect ATS frequency; and

c. Minor errors imply that the incorrect data has no impactoperational, for example typographical, grammatical, printing or formatting errors that do not directly cause operational difficulties but do not meet expected standards.

In addition to referring to document standardsICAO Doc.8126 (AIS Manual)Identification of critical data has also been defined internallybased onIn the Letter of Coordination Agreement (LOCA) document between PIA and the Flight Procedure Department, several types of data have been determined. If there is a discrepancy, a NOTAM must be issued immediately.

At LOCA 2025 betweenPIA with the Flight Procedure Department explains that there is a classification of critical data which is categorized as follows:

- a. Elevation (Aerodrome, THR RWY),
- b. Restriction (Level, Speed),
- c. coordinate,
- d. track bearing or radial,
- e. distance procedure design gradient,
- f. descent gradient/glide path angle/vertical path angle,
- g. OCA(H) or MOCA,
- h. Visibility,
- i. Minimum Sector Altitude,

- j. Prohibited, restricted, Danger Area,
- k. Turn Direction.

Furthermore, findings related to the details of UFB data for 2024. To understand in depth the characteristics of the data managed through the current workflow, an analysis of UFB reports received throughout 2024 was conducted. The findings from this analysis were that the reporting sources were very diverse, indicating the high level of attention from the global aviation community to the quality of Indonesian aviation data.

These reporting sources can be grouped into two main categories. The first is external sources, which are direct users of aviation mapping products. These external parties include leading global aviation data providers such as Jeppesen and Navblue, whose data is used by the majority of airlines worldwide. The second category is internal sources, which originate from findings from routine checks or internal audits.

Furthermore, analysis of the report reveals a wide variety of problem topics. To provide a clearer picture, these problem topics have been grouped according to their problem categories, as shown in Figure 1, as follows:

MONTH	SOURCE	ISSUE TOPIC	STATUS
August	Internal	Inbound Value Confirmation	OPEN
August	Jeppesen	Basemap Discrepancy	OPEN
August	Lufthansa	Chart and Coding Discrepancy	CLOSED
September	Navblue	Chart and Coding Discrepancy	CLOSED
September	Internal	Waypoint Information	CLOSED
September	Jeppesen	Chart and Coding Discrepancy	CLOSED
September	Lufthansa	Waypoint Information	CLOSED
September	Keyvan Aviation	Visibility Information	CLOSED
September	Internal	Visibility Information	CLOSED
October	Internal	WIR15 Discrepancy	OPEN
October	Jeppesen	Chart and Coding Discrepancy	OPEN
December	Navblue	Waypoint Coordinate Discrepancy	OPEN
December	Lufthansa	Station Name Discrepancy	OPEN
December	Jeppesen	Station Name Discrepancy	OPEN
December	Internal	Station Name Discrepancy	OPEN
December	aeronavdata	Station Name Discrepancy	OPEN
December	Jeppesen	Chart and Coding Discrepancy	OPEN
December	NAVBLUE	Coordinate Discrepancy	OPEN
December	Lufthansa	Bearing Information	OPEN

Figure 1 UFB Report Details for the Period August – December 2024

From the breakdown of problem topics in the table above, it is clear that reported issues are very diverse, ranging from navigation procedure issues, critical data issues such as waypoint coordinate discrepancies, and visual issues. The detailed image of the UFB report for December shows the topic of waypoint coordinate discrepancies (critical) in the pile of reports of name station discrepancies (minor). The findings indicate an unmitigated safety risk in the current workflow. The current large volume of data, if not managed through a structured system, has the potential to create long queues and slow response times to each incoming report.

To test whether the obstacles in handling UFB are an ongoing problem, the author also conducted an analysis of the UFB data reports received in 2025.

MONTH	SOURCE	ISSUE TOPIC	STATUS
January	Jeppesen	Bearing Information	CLOSED
March	Lufthansa	Turn Point Confirmation	OPEN
March	Internal	Waypoint Confirmation (Same as FRM.29.25.032)	OPEN
March	Navblue	Duplicate Coordinate Value	OPEN
March	Internal	Waypoint Confirmation (Same as 031)	OPEN
April	Jeppesen	Altitude Information	OPEN
April	Garmin	Altitude Information	OPEN
April	Lufthansa	Duplicate Coordinate Value	OPEN
May	Internal	IAF/FAF/IF Information	OPEN
May	Navblue	Chart and Coding Difference	OPEN
May	Jeppesen	Chart and Coding Difference	OPEN
May	Lufthansa	Bearing Information	OPEN
June	Royal Australian	Bearing Information	OPEN

Figure 2 UFB Report Details for the Period January - June 2025

The absence of a classification system delays the handling of safety-critical issues, reducing the effectiveness of risk mitigation and undermining the reliability of aeronautical information. From an efficiency perspective, FIFO without prioritization increases total lead time, impacts the chart revision cycle, and may erode user trust. Implementing a risk-based classification model could potentially reduce critical-issue resolution time by up to 50% while improving overall report handling efficiency.

Discussion of Research Results

The discussion will begin by analyzing gaps in the current workflow to identify the root causes. Next, in response to the second problem statement, a draft priority classification model will be presented as a proposed solution to address these constraints.

1. Discussion of Gaps in Current Workflow

This section will discuss in depth the problem findings presented in the research results section. The discussion focuses on a gap analysis to identify issues within the current UFB management workflow.

Table 3 Gap analysis

Present condition	Gap	Ideal Conditions	Reference
There is no formal, standardized screening procedure to sort reports at the initial stage.	Causing all reports to be treated equally, as there is no formal procedure at the outset to filter out the most urgent input.	There should be a classification mechanism at the beginning of the UFB data processing process to assist error analysis	Doc.8126 (AIS Manual)

A gap analysis revealed important findings regarding obstacles in the UFB processing process at the Cartography Unit. The current workflow aims to resolve the task queue, while the ideal UFB data processing flow should aim to mitigate safety risks. To answer the first problem formulation, SOP.033 is a procedure for the UFB data processing flow. The initial steps for mapping and analyzing the current user feedback (UFB) management workflow in the Cartography Unit can be illustrated in the following figure:

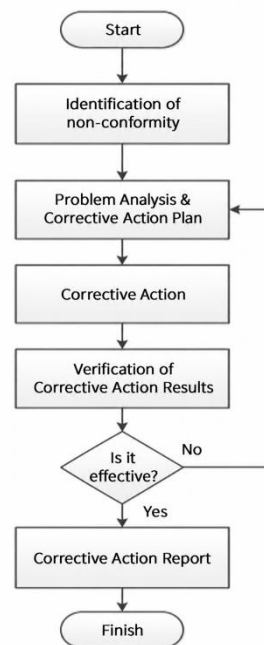


Figure 3 User Feedback Data Processing Workflow.

In detail, the stages in the User Feedback Data Processing workflow include:

- a. **Identification of Non-Conformities:** The initial stage is for any personnel at the Aeronautical Information Center to identify any non-conformities, including those originating from feedback from aeronautical chart users. These findings are then recorded on an official form (FRM.29 – Non-Conformity and Corrective Action Form) on the EARS (Electronic Aeronautical Reporting System) website.
- b. **Problem Analysis:** The cartography unit conducts a root cause analysis. At this stage, a corrective action plan and a timeline for implementation are determined.
- c. **Implementation of Corrective Actions:** The cartography unit executes the corrective plans that have been made according to schedule.
- d. **Corrective Action Verification:** Verification is performed to ensure that the corrective action taken has been effective. If it is ineffective, the process returns to the "Problem Analysis" stage. If effective, the nonconformance status is declared "CLOSE" or completed.
- e. **Corrective Action Results Report:** The final status of the handling of non-conformities is reported to the General Manager through the management review mechanism.

Based on the current UFB Data Processing Workflow in the Cartography Unit, the author concludes that the current handling of UFB data is not effective, because in SOP.033 regarding handling UFB complaints there is no classification mechanism at the beginning of the UFB data processing process to assist error analysis.

2. UFB classification model recommendations

Based on the gap analysis in the previous section, to address the second problem formulation regarding the UFB data classification model in the cartography unit, a solution approach was formulated in the form of a priority classification model. The purpose of this model is to provide a systematic method for Cartography Unit personnel to triage risks, so that each report can be handled according to its level of urgency.

The primary reference for creating this model is ICAO Doc. 8126 (AIS Manual), Section 6.2.2.8 on Error Analysis, which formally defines data error categories. Based on this reference, the following are the operational definitions for each category in the proposed model:

- a. The **CRITICAL** category is defined as a report containing errors that directly endanger the safety of air navigation. Examples of errors in the LOCA between PIA and the Flight Procedure Department include errors in elevation data, coordinates, obstacles, or flight routes;

- b. The MAJOR category is defined as reports that reveal missing, ambiguous, or difficult-to-interpret navigational or communication information. Errors in ATC frequencies, inconsistent waypoint names, or confusing procedures;
- c. The MINOR category is defined as incorrect data reports that do not impact flight operations, for example typographical, grammatical, or formatting errors that do not cause operational difficulties.

Based on the UFB classification model above, the author recommends improvements to SOP.033 on Non-Conformity Procedures and Corrective Actions in Cartography Units to ensure this model can be implemented effectively. In ICAO Doc. 8126 (AIS Manual), Section 6.2.1.5(b) also regulates the addition of software tools used to automatically divide data error levels.

In addition to procedural improvements, the authors also recommend a formal Person in Charge (PIC) designation for the UFB management process. PM 09 of 2023 (Subsection 175.C.1 - 175.080) mandates that Aeronautical Information Service Providers must have an organizational structure with clearly defined personnel duties and responsibilities. The appointment of a PIC aims to ensure accountability and consistency in the UFB classification process. With a clear classification model and a PIC responsible for UFB processing, the UFB processing workflow can change from being unstructured to a structured process.

The findings highlight significant inefficiencies in the current User Feedback (UFB) workflow, primarily due to the absence of an initial priority classification mechanism. This situation mirrors challenges documented in other Aeronautical Information Service (AIS) organizations prior to implementing structured classification models. For instance, a study by Santos et al. (2019) on user feedback classification approaches and operational reports from Eurocontrol's Aeronautical Data Quality (ADQ) framework both emphasize that prioritization not only shortens lead times but also significantly reduces safety risks. Similarly, the UK's NATS AIS introduced a severity-based triage system in 2017, which reduced resolution times for critical issues by over 40%. Compared to these cases, the Cartography Unit's current FIFO system remains reactive rather than risk-oriented.

Potential barriers to implementing the proposed model include staff training needs[11], as personnel must develop competency in risk-based assessment; integration challenges with existing SOP.033 procedures and the EARS platform; and the need for management buy-in to enforce the designation of a Person in Charge (PIC) for each UFB case. Without addressing these factors, even a well-designed classification model may fail to achieve its intended impact.

To facilitate adoption, a phased roadmap is recommended:

1. Preparation Phase – Revise SOP.033 to incorporate ICAO Doc. 8126 classification criteria and define PIC responsibilities.
2. Pilot Phase – Test the model on a subset of UFB cases, monitor resolution times, and gather user feedback.
3. Full Implementation Phase – Roll out the model across all UFB processing, supported by staff training and dashboard integration into EARS, informed by general web-system development [12] and user-interface/user-experience considerations [13].
4. Monitoring and Evaluation Phase – Track key indicators, including average resolution time per category, backlog trends, and compliance rates, conducting quarterly reviews to ensure continuous improvement.

This structured approach aligns with best practices from other AIS providers and ensures that the Cartography Unit can enhance both safety assurance and operational efficiency.

CONCLUSION

The current User Feedback (UFB) data processing workflow in the Cartography Unit is ineffective, as shown by the persistent backlog of unresolved cases, including safety-critical issues. This inefficiency is primarily due to the absence of a priority classification mechanism at the initial processing stage, which is vital for accurate error analysis and timely risk mitigation.

Incorporating the ICAO Doc. 8126 three-tier classification system Critical, Major, and Minor into SOP.033, along with the development of a dedicated UFB classification tool, is expected to deliver

measurable improvements. Specifically, the model is projected to reduce critical-case resolution times by up to 50%, decrease the backlog of safety-related reports, and improve overall operational efficiency.

Beyond immediate operational benefits, the model has the potential for broader application across other Aeronautical Information Service (AIS) contexts, including NOTAM management and obstacle data verification, enabling consistent safety prioritization across functions.

Further research should focus on integrating the classification model with automated tools and data management software, such as an enhanced EARS dashboard, to support real-time prioritization, monitoring, and accountability. Such advancements will ensure that the UFB workflow evolves into a proactive, risk-oriented system that strengthens both safety assurance and organizational performance.

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