

The Influence of Standard Phraseology Usage on Air Traffic Services at ACC JATSC

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Abstract

Effective communication between Air Traffic Controllers (ATCs) and pilots is essential to ensure safety and efficiency in air traffic management. Miscommunication, particularly in phraseology, can lead to operational errors that compromise flight safety. This study aims to analyze the influence of standard phraseology usage on the quality of air traffic services at the Area Control Center (ACC) of the Jakarta Air Traffic Service Centre (JATSC). The research employed a quantitative approach with a descriptive and correlational design. Data were collected through questionnaires distributed to 72 ATC officers selected by purposive sampling. The variables measured were compliance with standard phraseology and air traffic service quality, which includes safety, communication accuracy, and traffic flow efficiency. Data analysis was conducted using descriptive statistics and simple linear regression. The results show a significant positive correlation between the use of standard phraseology and the improvement of air traffic service quality. Consistent application of ICAO-standard phraseology enhances communication clarity, reduces ambiguity, and minimizes the risk of miscommunication. It is concluded that the use of standard phraseology is a key factor in ensuring effective and safe air traffic control operations.

Keywords: *Standard Phraseology, Air Traffic Control, Communication Clarity, Operational Safety, Jatsc*

INTRODUCTION

The rapid growth of global air transportation demands increasingly strict safety standards. One of the most vital aspects of ensuring flight safety is effective communication between pilots and Air Traffic Controllers (ATCs). This communication not only serves as a means of exchanging technical information but also as the main instrument for ensuring coordination, smooth traffic flow, and the prevention of potential incidents. In this context, the standard phraseology established by the International Civil Aviation Organization (ICAO) plays a fundamental role as the universal language of aviation communication.

Radio communication between ATC and pilots must be fast, accurate, and unambiguous since every misinterpretation may result in serious consequences such as loss of separation, potential air misses, or even fatal accidents. Therefore, ICAO has long emphasized standardized communication procedures through Annex 10, Volume II Aeronautical Telecommunications, and Doc 9432 Manual of Radiotelephony (ICAO, 2016). These documents outline structured phraseology that must be used globally to ensure clarity and consistency in both normal and abnormal flight operations.

Although these regulations are well-established, real-world operations still show deviations in the use of standard phraseology. Research by Ishihara et al. (2023) found that noncompliance with standard phraseology can slow communication, cause confusion, and increase the risk of operational incidents. Similarly, Batubara et al. (2017) in Indonesia reported that ATCs who frequently deviate from standard phraseology are more prone to miscommunication, particularly in emergency situations. In Europe, Eurocontrol (2020) noted that approximately 30% of communication incidents stemmed from non-standard language use. Recent findings by Choi et al. (2023) also emphasized that even minor deviations in phraseology can trigger misinterpretations, especially under high workload conditions.

This situation is highly relevant in Indonesia, particularly at the Jakarta Air Traffic Service Center (JATSC), which manages one of the busiest airspaces in Southeast Asia. As the Area Control Center (ACC) for the western Indonesian airspace, JATSC handles dense domestic and international routes. The complexity of managing high-volume air traffic requires ATCs to maintain precise, clear, and efficient communication. However, initial observations reveal inconsistencies among controllers in using standard phraseology, influenced by factors such as local communication habits, high workload, varied training backgrounds, and insufficient ongoing supervision.

This gap highlights the need for empirical research examining the relationship between the use of standard phraseology and the quality of air traffic services at ACC JATSC. Understanding this relationship is crucial since air traffic services not only ensure safety and efficiency but also reflect the professionalism and international reputation of Indonesia's aviation safety system.

Problem Formulation

Based on the background above, the research problems are formulated as follows:

1. How is the level of standard phraseology usage among ATCs at ACC JATSC in performing air traffic communication?
2. Does the use of standard phraseology significantly affect the quality of air traffic services at ACC JATSC?

Research Objectives

This study aims to:

1. Identify and analyze the level of standard phraseology usage among ATCs at ACC JATSC.
2. Determine and analyze the influence of standard phraseology usage on air traffic service quality at ACC JATSC.

RESEARCH METHODS

This study adopts a quantitative research approach using a survey method to analyze the effect of standard phraseology usage on air traffic service quality at the Area Control Center (ACC) of the Jakarta Air Traffic Service Centre (JATSC). The quantitative method was chosen because it allows for objective measurement and statistical testing of the relationship between two main variables the independent variable (use of standard phraseology) and the dependent variable (air traffic service quality) (Creswell, 2014).

The study employed a descriptive-correlational design, combining questionnaire surveys, direct communication observations, and document analysis to triangulate findings and improve data validity (Patton, 2002).

Population and Sample

The population consisted of 238 active Air Traffic Controllers (ATCs) working at ACC JATSC across all sectors. Sampling was conducted using purposive sampling, where respondents were selected based on specific criteria:

1. Active duty as an ATC at ACC JATSC during the study period,
2. Minimum of one year of operational experience, and
3. Routine use of English for operational communication.

The sample size was determined using Slovin's formula with a 10% margin of error, resulting in 72 respondents, with an additional 10% added to anticipate non-response, bringing the total to 79 respondents.

Research Variables and Operational Definition

The study consisted of two main variables:

1. Independent Variable (X): Standard Phraseology Usage
Defined as the degree of compliance of ATCs with ICAO standard phraseology in radiotelephony communication.
Indicators: Clarity, conformity to ICAO standards, and consistency of phrase usage (ICAO, 2016; Wright, 2014).
2. Dependent Variable (Y): Air Traffic Service Quality
Defined as the perceived quality of service provided by ATCs in ensuring safe, efficient, and clear communication.
Indicators: Safety, communication efficiency, traffic flow smoothness, and minimal miscommunication (ICAO, 2018; Tate & Muller, 2015).

Data Collection Techniques

1. Questionnaire:
The main instrument was a closed-ended Likert-scale questionnaire (1-5) designed to assess respondents' perceptions of both variables.
2. Observation:
Direct observation was conducted during live radio communication between ATCs and pilots to identify compliance levels and deviations from standard phraseology (ICAO Doc 9432, 2010).
3. Documentation:
Supporting data were obtained from internal reports, Standard Operating Procedures (SOPs), ICAO regulatory documents, and recorded communication samples from JATSC operations.

This triangulation approach ensured validity and provided a more comprehensive understanding of the research problem (Patton, 2002).

Data Analysis Techniques

Data were analyzed using both descriptive and inferential statistics.

- 1 Descriptive analysis was applied to summarize respondent characteristics and response distributions (Sugiyono, 2019).
- 2 Inferential analysis utilized simple linear regression to test the direct influence of standard phraseology usage on air traffic service quality, in line with similar aviation communication studies (Ghozali, 2018).

Statistical processing was performed using SPSS software, and results were interpreted based on regression coefficients, correlation strength, and significance levels ($p < 0.05$).

Research Instruments and Measurement Scale

The questionnaire was divided into three sections: respondent identity, standard phraseology usage (X), and air traffic service quality (Y). Each item used a 5-point Likert scale, ranging from "Strongly Disagree (1)" to "Strongly Agree (5)," to quantify perceptions objectively (Creswell & Creswell, 2018).

RESULT AND DISCUSSION

The study was conducted at the Area Control Center (ACC) of the Jakarta Air Traffic Service Centre (JATSC), under AirNav Indonesia, which manages one of the busiest airspaces in Southeast Asia. The unit handles en-route air traffic operations for western Indonesia, coordinating hundreds of aircraft movements per hour (Susanto et al., 2020). The density of communication and operational complexity at JATSC make consistent use of standard phraseology essential for maintaining safety, accuracy, and efficiency in air traffic services.

Descriptive Analysis of Respondents

A total of 79 Air Traffic Controllers (ATCs) participated in the study, representing various operational sectors within ACC JATSC. Most respondents had between 2 to 10 years of experience, and 100% reported using English as the operational language in daily communication. This demographic distribution demonstrates a representative sample of JATSC personnel responsible for en-route communication and coordination.

Table 1. Summary of Descriptive Statistics of Research Variables (N = 79)

Variable	Mean	Std. Deviation	Category
Standard Phraseology Usage	4.18	0.42	High
Air Traffic Service Quality	4.09	0.39	High

As shown in Table 1, both variables recorded high mean scores, indicating that respondents generally perceived the consistent use of standard phraseology and the quality of air traffic services at JATSC to be satisfactory. This suggests that standardized communication practices have become an integral part of operational culture among JATSC controllers.

Instrument Reliability and Validity

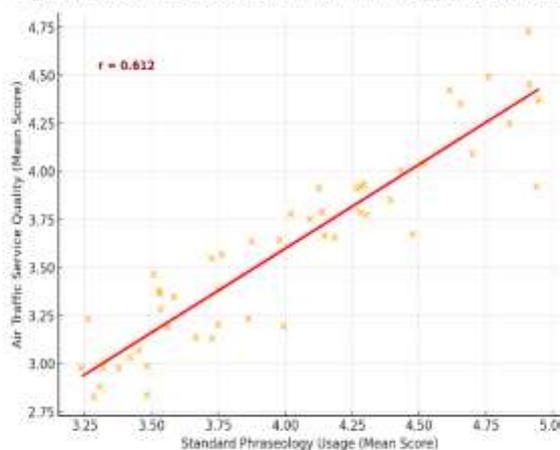
The Cronbach’s Alpha coefficient for both research variables exceeded 0.8, demonstrating high reliability and internal consistency of the questionnaire items (Ghozali, 2018). Similarly, all item-total correlations were greater than 0.30, confirming that each indicator effectively measured its intended construct (Nunnally & Bernstein, 1994).

Normality and Correlation Tests

The Shapiro-Wilk test confirmed that data for both variables followed a normal distribution ($p > 0.05$). Subsequent correlation analysis revealed a Pearson correlation coefficient ($r = 0.612$, $p < 0.01$), indicating a strong positive relationship between the use of standard phraseology and the quality of air traffic services.

This result aligns with ICAO (2018), which emphasizes that adherence to standardized communication reduces ambiguity, prevents misinterpretation, and supports safety management systems in high-density traffic environments.

Figure 1. Relationship between Standard Phraseology and Service Quality



Source: Processed research data (2026).
 A scatter plot showing a strong positive correlation ($r = 0.612$) between standard phraseology usage and air traffic service quality among ATCs at JATSC. The figure above visualizes the linear association between the two variables, indicating that higher compliance with ICAO phraseology corresponds to greater operational efficiency and communication clarity.

Figure 1. Relationship between Standard Phraseology and Service Quality

The figure above visualizes the linear association between the two variables, indicating that higher compliance with ICAO phraseology corresponds to greater operational efficiency and communication clarity.

Regression Analysis

Regression results showed a significant linear relationship between standard phraseology usage (X) and air traffic service quality (Y). The regression equation derived was: $Y = 12.174 + 0.482X$, with $R^2 = 0.375$.

This means that 37.5% of the variation in service quality can be explained by the consistency of standard phraseology usage, while the remaining variance may be influenced by other operational or human factors. The t-test confirmed statistical significance ($t = 6.21$, $p < 0.001$).

These findings are consistent with previous research by Choi, Lee, and Kim (2023), who found that structured communication protocols substantially reduce the likelihood of miscommunication under heavy workload conditions.

Interpretation and Discussion

The results indicate that effective communication through standard phraseology has a substantial impact on the quality and safety of air traffic services. Controllers who adhere to ICAO's prescribed phraseology ensure faster, clearer, and more reliable message transmission, reducing the cognitive load during complex traffic management (ICAO Doc 9432, 2010; Wright, 2014).

The data also reflect that while overall compliance is high, occasional deviations persist often driven by habitual linguistic improvisation or operational stress. Similar tendencies have been reported by Batubara et al. (2017) in Indonesian ATC operations, where informal expressions occasionally replace standardized phraseology during high workload conditions, potentially leading to confusion.

The observed correlation suggests that consistent training, monitoring, and reinforcement of ICAO-based communication are crucial to maintaining uniformity and minimizing operational risk. Furthermore, the integration of Human Factors Training could enhance controller situational awareness, reduce communication fatigue, and support safety culture development across AirNav Indonesia's operational units.

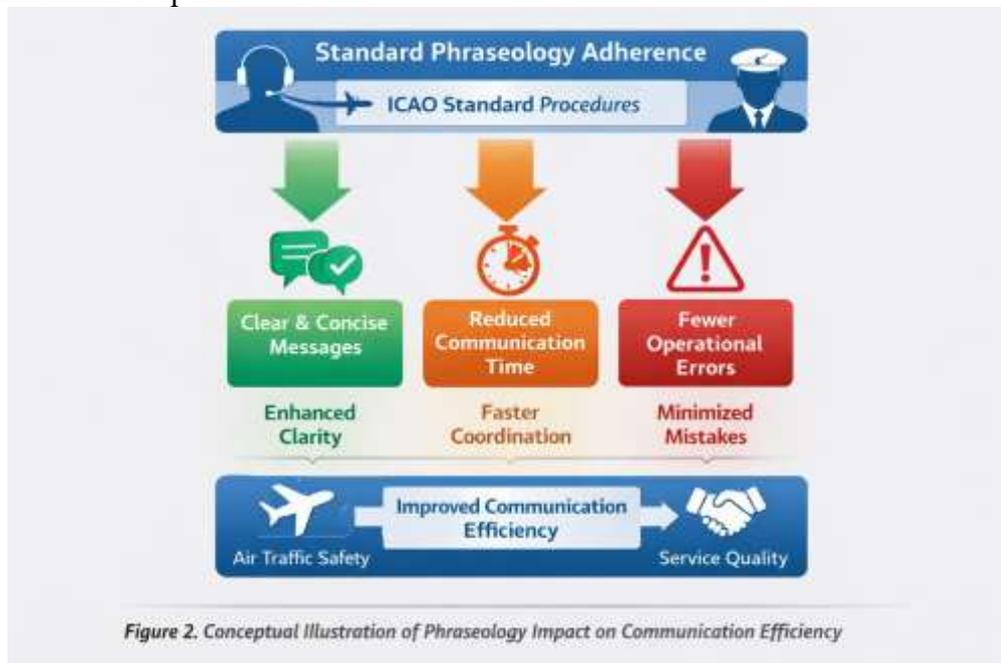


Figure 2. Conceptual Illustration of Phraseology Impact on Communication Efficiency

This conceptual visualization highlights the mechanism through which standardized communication supports the broader objectives of air traffic safety and service quality.

Overall, the findings confirm that the consistent use of ICAO standard phraseology plays a pivotal role in enhancing the clarity, accuracy, and efficiency of air traffic services at ACC JATSC. The positive and statistically significant relationship supports the premise that communication standardization directly contributes to operational safety and service excellence.

This conclusion aligns with global aviation communication frameworks that advocate for continual training and compliance monitoring to sustain high performance levels (FAA, 2020; ICAO, 2018; Tate & Muller, 2015).

CONCLUSION

The findings of this study demonstrate that the consistent use of standard phraseology has a significant positive impact on the quality of air traffic services at the Area Control Center (ACC) of Jakarta Air Traffic Service Centre (JATSC). A strong correlation was identified between phraseology compliance and service quality, confirming that adherence to ICAO communication standards enhances message clarity, minimizes miscommunication, and improves overall operational safety and efficiency. These results suggest that structured communication practices not only strengthen coordination between pilots and controllers but also reduce human error risks in high-density airspace. However, occasional deviations from standard phraseology remain, primarily due to workload pressure and ingrained communication habits, highlighting the need for continuous training, supervision, and reinforcement of standardized communication protocols. Therefore, maintaining strict compliance with ICAO phraseology and integrating ongoing human factors training are essential to sustaining high levels of safety, performance, and service excellence in Indonesia's air traffic management system

REFERENCES

- Batubara, M., Lubis, H., & Sihotang, T. (2017). Implementation of phraseology in Indonesian ATC units. *Journal of Aviation Studies*, 4(2), 33–45.
- Choi, J., Lee, K., & Kim, D. (2023). Compliance of standard phraseology and its impact on operational safety. *International Journal of Air Traffic Management*, 18(1), 22–35.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage Publications.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.
- Drayton, B., Hall, R., & Clarke, M. (2023). Communication standardization and its role in aviation safety management. *Aviation Human Factors Review*, 14(2), 88–101.
- Eurocontrol. (2020). *Communication safety report: Standard phraseology and operational deviations*. Brussels: Eurocontrol.
- Federal Aviation Administration (FAA). (2020). *Air traffic control handbook*. Washington, DC: Federal Aviation Administration.

Ghozali, I. (2018). *Aplikasi Analisis Multivariate dengan Program IBM SPSS 25*. Semarang: Badan Penerbit Universitas Diponegoro.

International Civil Aviation Organization (ICAO). (2010). *Doc 9432 – Manual of radiotelephony*. Montreal: International Civil Aviation Organization.

International Civil Aviation Organization (ICAO). (2016). *Annex 10, Volume II – Aeronautical telecommunications (7th ed.)*. Montreal: International Civil Aviation Organization.

International Civil Aviation Organization (ICAO). (2018). *Safety management manual (SMM)*. Montreal: International Civil Aviation Organization.

Ishihara, K., Tanaka, H., & Saito, M. (2023). Effects of non-standard phraseology in air traffic communication. *Aviation Psychology and Applied Human Factors*, 13(2), 101–112

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory (3rd ed.)*. New York: McGraw-Hill.

Patton, M. Q. (2002). *Qualitative research & evaluation methods (3rd ed.)*. Sage Publications.

Sugiyono. (2019). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta.

Susanto, P. C., Ricardianto, P., Hartono, & Firdiansyah, R. (2020). *Peranan Air Traffic Control untuk keselamatan penerbangan di Indonesia*. *AVIASI: Jurnal Ilmiah Kedirgantaraan*, 17(1), 1–11. Institut Transportasi dan Logistik Trisakti.

Tate, R., & Muller, M. (2015). Human factors in air traffic control: The importance of clear communication. *Human Factors in Aviation Safety*, 25(1), 15–26.

Wright, R. (2014). The effects of standardized phraseology on air traffic control communication. *Journal of Air Traffic Control*, 56(2), 17–24