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The Influence of Noice Levels in The Cabin Tower on The Work Environment of Air Traffic Controllers at Airnav Indonesia, Subranch Gorontalo

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Abstract:
This study was conducted at the Perum LPPNPI Branch Office in Gorontalo, Gorontalo Province, from January to June 2024. The background of this research is the inadequate condition of the cabin tower and substandard communication equipment, which disrupt the performance of Air Traffic Controllers (ATC). The aim of this study is to determine the impact of noise in the cabin tower on the working environment of ATC. It is hoped that this research will provide solutions to the noise impact and help ATC achieve a compliant and comfortable working environment for providing air traffic services. The method used is quantitative. Data collection involved using a Likert scale questionnaire and direct noise measurement with a sound level meter, specifically the Uni T - UT 353 model. Data analysis was performed using Pearson's Product-Moment Correlation, coefficient tests, and regression. The study population consisted of 8 ATC personnel at the AirNav Tower unit in Gorontalo. The results showed a strong correlation between noise in the cabin tower and the ATC working environment, with a correlation coefficient of 0.823 and a determination coefficient of 67%. This means that noise affects the working environment by 67%, while the remaining 33% is influenced by other factors not examined. These findings emphasize the importance of addressing noise issues to enhance ATC performance and work comfort.
Keywords: Cabin Tower, Noise, Work Environment, Air Traffic Controller, Flight Traffic Services, Airnav Indonesia.

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Introduction

The air navigation services at Djalaludin Airport are managed by Penyelenggara Pelayanan Navigasi Penerbangan Indonesia (Perum LPPNPI) Branch Office Gorontalo, commonly known as Airnav Indonesia Gorontalo Branch. The types of navigation services provided by Airnav Indonesia Gorontalo Branch include Aerodrome Control Tower, Approach Control Procedural, and Terminal Control Area, where all these services are combined into a single callsign, "Djalaludin Tower." Therefore, supporting facilities are needed to optimize the service delivery. This is aimed at ensuring safety and security in aviation according to existing procedures and in line with the five pillars outlined in Annex 11 Air Traffic Services, Chapter 2.2.2 regarding the five objectives of air traffic services (ICAO 2018).

In providing navigation services, the coordination tools available at the Djalaluddin Tower unit are as follows: 1 (one) Handie Talkie (HT) connected to the HT unit at Djalaluddin Airport Gorontalo, 1 (one) direct speech line with Manado Approach, 1 (one) long-distance call (SLJJ) for coordination with other ATS units in the Gorontalo area, 1 (one) direct speech line for coordination with the ACC endpoint, 1 (one) direct speech line for coordination with the Ujung

Info, and 1 (one) Private Automatic Branch Exchange (PABX) for coordination with other units in the Perum LPPNPI Gorontalo Branch Office.

The problem in communication between the Air Traffic Controller (ATC) and the pilot or other units within the Djalaluddin Tower cabin is noise. This disturbance source is the noise from aircraft engines reaching the tower cabin, causing the direct speech coordination to be unclear, potentially leading to coordination errors between the assistant and other units. The primary cause of this noise is the tower being too close to the aircraft parking stand position. Additionally, the tower cabin lacks soundproofing. The condition inside the Gorontalo tower cabin also shows that the room construction still uses plywood for the floor and regular bricks for the walls. As a result, the tower cabin cannot reduce the sound leakage from outside.

Figure 1. Airnav Indonesia Cabin Tower Condition and Position Parking Stand From Cabin Tower

In this case, the units that coordinate are affected by the noise. Coordination plays a crucial role in air traffic services. The coordination between the assistant controller and other related units must be clear as it involves the issuance of clearance, instruction, and information (Ishak Herwandi Cahyono 2018). Additionally, the assistant controller in the Gorontalo tower cabin still uses regular telephones without headsets, which can pose an additional hazard that disrupts air traffic services. Moreover, the controller's desk is cluttered with several communication devices, such as direct speech lines, PABX, and SLJJ. There are at least five communication devices positioned imprecisely, filling the control desk. The similar sound of the direct speech from Manado Approach and Ujung Info, and the nearly identical sound of the direct speech from Ujung ACC, often cause the assistant/controller to pick up the wrong line.

Figure 2. Coordination Unit Djalaluddin Tower

In this case, several problem factors within the tower cabin can disrupt the comfort of the ATC personnel in providing navigation services. If not addressed, these issues will have serious future consequences and endanger flight safety. A conducive working environment is considered very important in daily life, especially in the workplace.

ICAO Doc. 9426 explains that an ATC must have a comfortable working environment while on duty, one aspect of which is being free from noise. This is stated in Doc. 9426 Part III Section II Sub-Chapter 1.2 Operational Requirement: "Controllers should be able to work at their positions without physical discomfort. The environment should be sufficiently free from noise so as to be conducive to mental concentration" (ICAO 1984).

According to (Nur 2019), with the creation of comfort in mind and feeling, an ATC officer will be more focused and concentrated in serving flights within their jurisdiction. Therefore, comfort in the workplace becomes crucial in achieving optimal results. In line with the issues and background of the noise, the author is motivated to conduct research to determine whether this problem affects the ATC Working Environment at Perum LPPNPI Gorontalo Branch Office.

Literature Review

In this study, the author uses several official documents related to noise where the rules are made by the government and international organizations involved in standard aviation regulations. For the noise regulations themselves, the government stipulates that Airport Business Entities or Airport Operator Units are required to maintain noise and environmental pollution thresholds at airports and their surroundings in accordance with the thresholds and quality standards set by the Government (Indonesia 2014). In the International Civil Aviation Organization document, it is recommended that noise levels in control rooms, such as tower cabins, ideally be in the range of around 55 dB or close to that number (ICAO 1993). Not only that, ICAO itself has actually regulated specifications regarding cabin tower infrastructure so that ATC has the ability to communicate quickly, clearly, and reliably using aircraft in its area of responsibility (ICAO 1984). This study is also supported by several published journal references. (Atina and Safitri 2020) state that noise measurement can mean the process of obtaining the intensity and frequency of noise in a place or company, where the results of these measurements can be used to reduce noise intensity and avoid interference.

Not only that, the working environment of an ATC has also been regulated by the government and official organizations that regulate international flight regulations, in government regulations themselves, the working environment can mean a combination of social, psychological, and physical life in a company which really influences employees to carry out their responsibilities. In life, it is impossible to separate humans from the environment around them, so that the working environment influences employee performance. The condition of the working environment has a crucial role because it can influence the physical and non-physical conditions of employees, such as noise, lighting, and relationships between employees, which directly affect employee performance (Singkam 2020).

The ATC Work Environment Standard itself is regulated by the International Civil Aviation Organization (ICAO) Operational Requirement (1984) which explains how important it is for ATC personnel on duty to feel a comfortable Work Environment, in this case an example is the cabin tower (ICAO 1984). Not only that, the provisions for the ATC Environment work atmosphere are also regulated but also regulated by the Republic of Indonesia Ministry of Transportation in the CASR 170 document point 170.061 ATS Operational Requirements, the

contents of which are that controllers must be facilitated with appropriate work environments and tools. The Work Environment must be safe and comfortable and must provide protection from disturbing elements (Perhubungan Udara 2019).Not only supported by official documents, the ATC work environment is also supported by valid research journals where According to (Nur 2019) By creating comfort, thoughts and feelings, an ATC officer will be more focused and concentrated in serving flights in his jurisdiction.

Results and discussions

The research was conducted in the Aerodrome Control Tower of the Gorontalo branch of Perum LPPNPI (AirNav Gorontalo). This study uses 2 variables: noise as variable x and the work environment as variable y. To collect data for variable x, noise measurements were taken over 6 days during peak hours, the busiest periods of traffic each day, with measurement intervals every 10 minutes. The measurement results were then calculated to obtain the average value.

Figure 3. Noise Data Collection

Variable Y in this study, which represents the Work Environment level, uses primary data. A questionnaire was used to collect data from all ATC personnel at AirNav Gorontalo. The questionnaire consisted of 11 questions and was completed by 8 respondents. Data on Variable Y, the Work Environment, was organized into a table and scored using a Likert scale with a value range of 1-5.

Table 1. Scale of Questionnaire Result

Answer	Description	Score
SD	Strongly Disagree	1
D	Disagree	2
N	Neutral	3
A	Agree	4
SA	Strongly Agree	5

In processing the data, the author conducted a quantitative analysis of the observational data obtained from direct measurements of noise levels. Subsequently, data from surveys or questionnaires were tabulated according to the existing variables. The author applied data processing techniques with the aim of finding correlations between noise levels and the work environment at the "ATC of Perum Lembaga Penyelenggara Pelayanan Navigasi Penerbangan Indonesia, Gorontalo Branch Office." The steps in this research technique included testing the

research instrument, testing data normality, hypothesis testing, and simple linear regression analysis.

During the research, the results showed that in the cabin tower room of Airnav Gorontalo Branch at Djalaluddin Airport, the noise level ranged between 66-68 dB. This indicates that the noise level has exceeded the noise threshold value (NAB) recommended by ICAO, which is 55 dB. Noise in the ATC work environment has an impact of 67% and has a significant relationship with the ATC work environment at AirNav Gorontalo.

The obtained correlation coefficient is 0.82, indicating a correlation between Noise (X) and the Work Environment (Y) of air traffic controllers at a percentage of 82%. The intercept obtained is 28.002, indicating that when the value of the independent variable (X) is 0, the value of the dependent variable (Y) is 28.002. The slope value (B) is -2.893, which shows that the Noise variable (X) has a negative effect on the ATC Work Environment (Y). This means that every increase in the Noise variable (X) will result in a decrease in the ATC Work Environment variable (Y) by -2.893.

Table 2. Calculation Results of the Determination Test

R^2	R^2 x 100%
0,67	67%

Table 3. Calculation Results of the Product Moment Corelation Test

R Hitung	R Tabel
0,823	0,706

Table 4. Results of Simple Linear Regression Test

Variabel	Coefficient
Intercept value	28.002
Noises	-2.893

Based on the results obtained, the author suggests several solutions to reduce noise inside the AirNav Gorontalo cabin tower. These include installing soundproofing materials such as glasswool carpets on floors and walls, and UPVC installation to seal gaps in windows and doors, thereby reducing noise intensity. Additionally, the installation of Active Noise Control (ANC) panels throughout the cabin tower, including walls and ceilings, can effectively dampen noise. Proper placement and system design tailored to the layout and specific needs of the ATC cabin tower are crucial for the success of ANC devices. Using headsets or headphones by assistant controllers during duty can also minimize noise, ensuring clearer communication via radio communication systems like the Voice Communication Control System (VCCS).

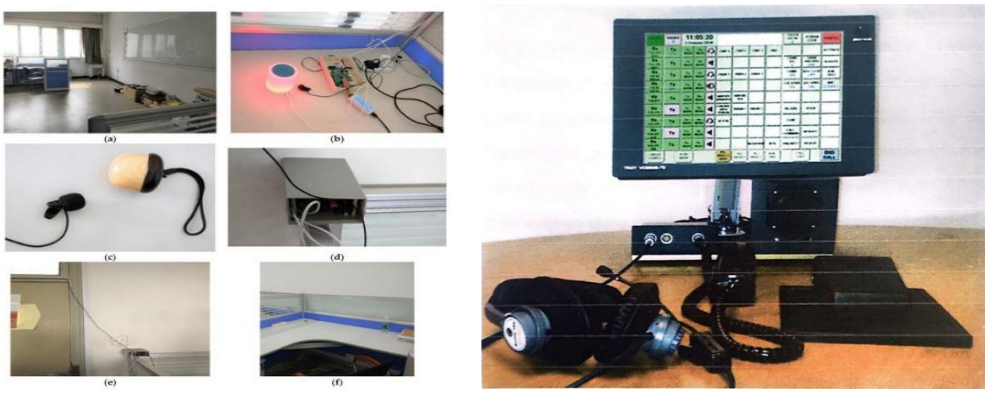

Figure 4. Active Noise Control (ANC) and Voise Communication Control System (VCCS)

Conclusion

During research in the cabin tower room of Airnav Gorontalo Branch at Djalaluddin Airport, the noise level ranged between 66-68 dB. This indicates that the noise level has exceeded the noise threshold value (NAB) recommended by ICAO, which is 55 dB. Noise in the ATC work environment has an influence of 67% and has a significant relationship with the ATC work environment at AirNav Gorontalo.

The correlation coefficient obtained is 0.82, indicating a correlation between Noise (X) and the Work Environment (Y) of air traffic controllers at a percentage of 82%. The intercept obtained is 28.002, indicating that when the independent variable (X) value is 0, the dependent variable (Y) value is 28.002. The slope (B) value is -2.893, indicating that the Noise (X) variable has a negative impact on the Work Environment of ATC (Y). This means that each increase in the Noise (X) variable will result in a decrease in the ATC work environment (Y) variable by -2.893.

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