THE EFFECT OF ENGINE NOISE ON CADETS AT THE INDONESIAN AVIATION ACADEMY VOCATIONAL SCHOOL BANYUWANGI

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ABSTRACT

Noise is a sound that causes sound violence and disturbs humans. In the aviation industry, noise affects flight safety and success because it can interfere with the concentration and performance of flight cadets. In addition, high intensity can also cause stress and fatigue in flight cadets, reducing their ability to maintain focus and respond to critical situations. This study aimed to analyze the impact of noise produced by engine sounds and radio signals on pilots. The results of this study on the aircraft dashboard sound noise value is greater because the aircraft dashboard clan is located adjacent to the engine while the smallest noise value is found in data retrieval in the back seat because it is farther from the engine. The data collection carried out produces output in the form of data resulting from the effect of engine noise on cadets.

Keywords: noise, cadets, engine sound

INTRODUCTION

Noise is a sound that comes from various industrial activities, trade, power generation equipment, means of transportation, household activities and others. Technology in the form of information communication facilities, production, transportation, and entertainment is developing very rapidly so that proper handling is needed to minimize noise [1]. Sound that has a hardness of 30-65 dB if received continuously will disturb the telhinrhage and cause anxiety, while in the range of 65-90 dB will damage the vegetative layer of humans (heart, blood circulation and others). When the noise reaches the range of 90-130 dB will damage the ears.

In the aviation industry, flight safety and success depend heavily on the concentration and performance of aviation cadets[2],[3]. However, certain factors can affect their ability to stay focused and perform optimally. One significant factor is the engine noise produced by aircraft [4],[5]. Engine noise refers to the sound produced by an aircraft engine while operating. This sound can come from various components such as air compressors, combustion systems, and other aircraft propulsion systems [6]. Although advanced technology has been used to reduce aircraft noise, the intensity and characteristics of engine noise can still affect aviation cadets.

Engine noise intensity can negatively impact the concentration and performance of aviation cadets [7]. Increased intensity of engine sounds can interfere with verbal communication between flight cadets inside the cockpit, which can lead to communication errors and decreased quality of instruction comprehension [8]. In addition, high intensity can also cause stress and fatigue in flight cadets, reducing their ability to maintain focus and respond to critical situations [9],[10],[11]. Engine noise characteristics such as frequency, duration, and repetitive patterns can also affect the concentration and performance of aviation cadets. Machine sound frequencies that are similar to other important sound frequencies can interfere with the ability to hear important signals around them [12],[13], [14].

Long sound duration or monotonous repetitive patterns can cause boredom and hearing discomfort, reducing the concentration and performance levels of aviation cadets. To reduce the impact of engine noise on the concentration and performance of flight cadets, steps need to be taken, one of which is the design of quieter aircraft engine dampers with effective noise reduction systems. Training of flight cadets to overcome interference due to engine noise, use of hearing aids, regular assessment of hearing conditions. This study aimed to analyze the impact of noise produced by engine sounds and radio signals on pilots. The resulting data can be used as a reference for scientific analysis for exposure to noise obtained

by pilots, because noise in the cockpit of aircraft has the potential to affect the health and work performance of pilots.

RESEARCH METHOD

The purpose of the study was to obtain the effect of engine noise intensity and characteristics on the concentration and performance of aviation cadets. The data obtained involved a literature review as well as direct measurements in the field by measuring sound noise in the cockpit of a Cessna 172S aircraft. Analysis of this study can be a consideration of aviation safety and success.

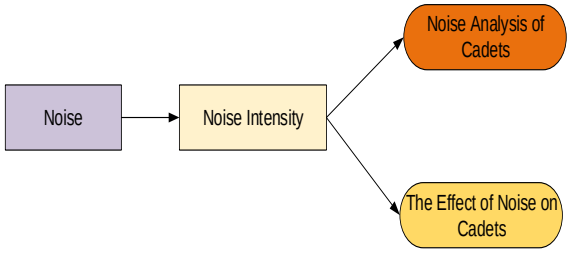


Figure 1. Frame of Mind

Based on the frame of mind in figure 1. So, it can be explained that noise is a sound that causes interference with human comfort and health. The intensity of sound noise can negatively affect the concentration and performance of aviation cadets. The pattern of noise intensity affects the quality of teaching and learning and has an impact on the quality of human resources. The pattern of noise intensity in humans can be seen in the following figure.

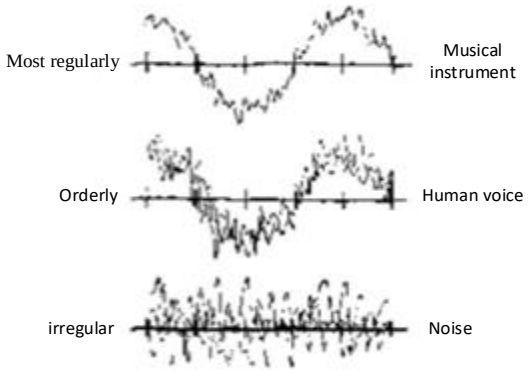


Figure 2. Various patterns [15]

Increased sound intensity can interfere with verbal communication between flight cadets in the cockpit, which can lead to communication errors and decreased quality of instruction comprehension. Noise analysis will be carried out because pilot health and performance are crucial factors in maintaining flight safety, given that pilots are the most vital element in safety aspects in the aviation industry. There are various assumptions that affect the level of noise on human health according to the Minister of Health of the Republic of Indonesia No.718 / Men / Kes / Per/XI / 1987, about noise related to health maximum and minimum noise levels in health can be seen in the following table figure.

No		Noise Level (dBA) Maximum Zone recommended	Maximum Zone allowed
1	A	35	45
2	B	45	55
3	C	50	60
4	D	60	70

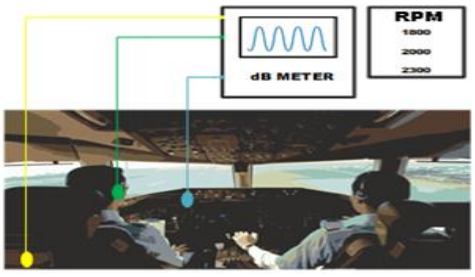
Figure 3. Maximum &; Minimum Noise Levels [16].

Decree of the State Minister of Environment Number KEP.48/MENLH/11/1996, dated 25 November 1996 concerning noise level standards for Area Allocation or Environmental Activities can be seen in the following table figure.

No	Environmental area	Noise level dB(A)
1	Housing and settlements	55
2	Trade and services	70
3	Offices and commerce	65
4	Green open space	50
5	Industry	70
6	Airport	75
7	Government and facilities	60
8	Recreation areas	70
9	hospital	55
10	School	55
11	Worship place	55

Figure 4. Noise Quality Standards [17]

The data obtained in this study used a sound level meter device that was carried out directly inside the aircraft when the aircraft was on ground. Sound noise picking was carried out at 10-minute intervals during the 2-hour flight. Furthermore, the data obtained will be analyzed to determine the effect of intensity and engine noise characteristics on the concentration and performance of aviation cadets using RPM variations of 1800, 2000, 2300. The data collection uses a sound level meter device placed at 3 data collection points, namely on the aircraft dashboard, pilot ears, and the Rear Seat. The research scheme can be illustrated as follows.



Information :

Aircraft Dashboard
Pilot's Ears
Rear Seat

Figure 5. Data Retrieval Methods

RESULT AND DISCUSSION

Result

The results obtained in this study were in the form of noise values carried out by taking data three times. The results of the research that have been carried out obtained results in the form of noise values as follows:

Table 1. First test result data

	Variation RPM	Aircraft Dashboard	Pilot's Ears	Rear Seat
T1	1800	92,4	88,1	86,3
	2000	94,1	89,4	88,1
	2300	100,1	94,2	89,6

Table 2. Data from the second test results

	Variation RPM	Aircraft Dashboard	Pilot's Ears	Rear Seat
T2	1800	94,1	89,1	87,3
	2000	95,7	90,7	89,8
	2300	100,5	95,1	89,9

Table 3. Data from the third test results

	Variation RPM	Aircraft Dashboard	Pilot's Ears	Rear Seat
T3	1800	94,7	89,9	88,1
	2000	96,1	91,3	89,7
	2300	100,8	95,9	92,1

Tables 1, 2, and 3 are data from data retrieval repeated 3 times with the same 3 aircraft but with different service lives. The different types of such aircraft can be seen in the following table:

Table 4. Types of aircraft

Aircraft Type	**Aircraft Registration Mark**	**Production year**	**Total of Landing**	**Information**
Cessna 172 S	PK-APA	2018	3.119	OH Engine
Cessna 172 S	PK-APF	2018	3.002	-
Cessna 172 S	PK-BYJ	2015	3.724	-

The data collection carried out produces output in the form of noise result data which is used as technical reporting related to noise thresholds in accordance with the Regulation of the Minister of Manpower and Transmigration of the Republic of Indonesia Number PER.13 / MEN / X / 2011 concerning threshold values in the workplace and is an Indonesian National Standard (SNI).

Discussion

Based on the data obtained in Tables 1, 2, and 3, various graphs are obtained as shown in Figure 6-8.

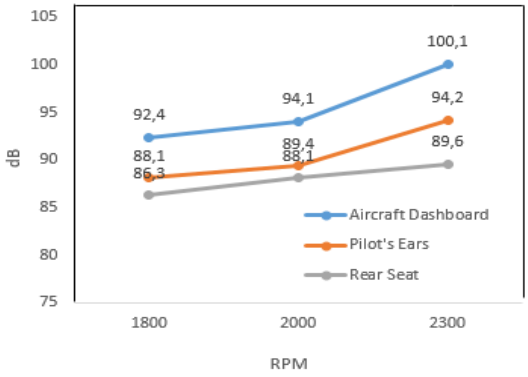


Figure 6. First noise test graph.

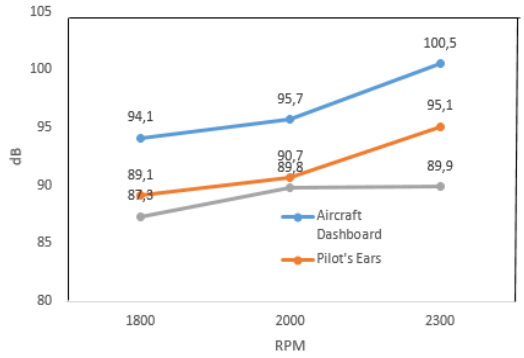


Figure 7. Second noise test graph.

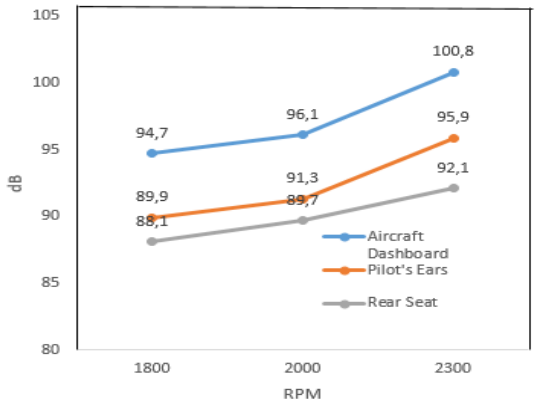


Figure 8. Third noise test graph.

Figures 6, 7, and 8 are graphs of the data collection results in tables 1, 2, and 3. Where the graph shows the results of the largest noise value in front of the aircraft dashboard then for the lowest noise value is in the back seat of the aircraft. Taking data from the three images shows that the higher the RPM, the higher the noise value, this is because the higher the RPM, the engine vibration on the aircraft is also higher so that the vibration causes increased noise.

Data retrieval at 3 points also affects the noise value, the farther away from the engine sound, the sound noise value is smaller than the data collection point adjacent to the machine. The data retrieval adjacent to the engine is at the dashboard point and

the farthest data retrieval from the engine is at the rear seat point so that the largest noise value is found on the dashboard while the smallest noise value is in the rear seat.

From the data collection, it can instruct aircraft technicians to reduce the noise on the aircraft because it has exceeded the threshold of human noise in accordance with the Regulation of the Minister of Manpower and Transmigration of the Republic of Indonesia Number PER.13 / MEN / X / 2011 concerning threshold values in the workplace and is an Indonesian National Standard (SNI). The phenomenon of noise waves produced is a longitudinal wave because the wave is a wave where propagation requires a medium, the wave medium in this study is played by vibrations in aircraft engines that cause sound noise.

CONCLUSIONS

In this study, the measurement on the aircraft dashbord of the sound noise value is greater because the dashbord of the aircraft is located adjacent to the engine, while the smallest noise value is found in data retrieval in the back seat because it is farther from the engine. Noise that occurs in Cessna 172 S aircraft can lead to reduced pilots' ability to stay focused and perform optimally. Research on noise generated by Cessna 172 S aircraft has affected pilots and exceeded the noise threshold set by the Regulation of the Minister of Manpower and Transmigation of the Republic of Indonesia Number PER.13 / MEN / X / 2011 concerning threshold values in the workplace and is an Indonesian National Standard (SNI). In this research, research development can be carried out where data collection can be done on variations in aircraft altitude, because air temperature and air humidity affect sound noise.

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