Effect Of Maintenance System And Simulator Pilots On Aviation Safety In Airlines

S. D. Rahmawati*, S. J. R. Maulida, S. Rafi, Devi Ratnasari

Institute of Transportation and Logistic Trisakti, Jakarta, Indonesia

*Email: sriditarahmawati@gmail.com

Abstract. Safety and security are a priority in an aviation industry that is very mindful because it is crucial. In order to achieve that virtue, there are some things that must be noticed by the airline in supporting safety and security is the maintenance system which pays attention to the profanation of an aircraft to operate and a pilot simulator to prepare physical and mental pilot readiness in all natural situations and conditions while minimizing the risk of falling planes, two factors affecting the pilot's performance in operating the aircraft will reduce the accident rate significantly and can improve the pilot's ability to deal with problems in the field through certain simulations related to these problems. This research aims to study flight readiness in terms of feasibility control by maintenance system and pilot readiness in the face of emergencies and decision making in crucial situation. This research uses a regression method whereby the data retrieval technique uses the questionnaire with the target of the pilot respondent of the airline Garuda Indonesia. The result of analysis Acquired linear equation multiple regression Y = 0.754 + 0.383X1 + 0.398X2, R is obtained at 0.518.

1. Introduction
Indonesia is the world's largest archipelago, located in Southeast Asia. The role of air transport in Indonesia plays a very important role as a tool for transferring passengers to a country or region and also transferring goods. Because air transportation is very easy and shorten the time to do an activity.

In accordance with Article 3 of Law No. 15 of 1992 on flight safety The implementation of the airline is to ensure that safe, secure, fast, smooth, orderly, comfortable and powerful flights are maintained at an affordable cost by the purchasing power of the public by prioritizing and protecting national aviation, promoting equitable growth and stability as a driving force.

The government has always increased its commitment to safety in aviation. Intensity is the most important major factor in air transport. Some ways to maximize safety by conducting a pilot simulator and maintenance system, because the pilot simulator and maintenance system serve as an aircraft operation feasibility. Because of flight validity, the main thing the community sees as an "image" of an airline. If the community looks better at more and more accidents.

Any airline is very unwanted by plane accidents because it can harm many parties. Good or even the best airlines can experience aircraft accidents. Therefore, the performance of a pilot and the feasibility of an aircraft engine used must be optimally evaluated by an airline. Simulators can perform pilot performance evaluation and periodic maintenance systems can be used for machines used to become safety culture run by airlines.
Because aircraft are now progressively reliable, the percentage of crashes resulting from pilot mistakes has risen and now reaches 50%. Aircraft consist of complicated machines that require a lot of maintenance. As pilots are actively involved with the aircraft at each point of the flight, there are many possibilities for mistake, from inability to correctly program the Flight Management Computer (FMC) Although errors are heavily prevented, it is essential to remember that when accidents occur, pilots become the last line of defense. Although the quality of design and manufacturing continues to improve, equipment defects still accounted for 20 percent of aircraft crashes. Therefore, necessary commitment in the schedule of maintenance.

2. Literature Review

2.1. Maintenance System

Maintenance is an activity that ensures that a component or system contained in the aircraft still works in accordance with the wearer's wishes. This is necessary because parts of the aircraft are subject to a certain age limit, so even if the component does not or does not perform its duties but the age or age limit of use has reached the limit, the components must be replaced immediately. Therefore, good care and supported by well-arranged treatment data will make the function of an aircraft or reliability to stay awake and make the aircraft have a long life and remain in good condition.

The concept of maintenance of air aircraft (also other industries) is known as [1]

a. fixed it when broke
b. preventive maintenance
c. Hard Time (HD)

2.2. Flight Simulator

Flight simulation is essentially a way to create real flight conditions. Some aeronautical areas such as aviation dynamics, navigation and aeroelasticity behaviour can be studied in artificial computing environments. Flight simulation has made its use for both professional and casual purposes. One of the most useful traits of flight simulation is to allow the military or civilian pilots to practice. Being in a simulated environment allows training of live maneuvers, practicing complex missions and, of course, improved piloting skills. The benefits of flight simulation are [2]:

a. Safety: As said before, flight simulation allows pilots to face dangerous situations that may occur in a real flight. It also allows experienced pilots to collect motor skills and basic flight procedures. The Simulator is also used as a testing device for newly designed aircraft, therefore they can estimate the possibility of design failures. Understand and memorize the order (Normal Procedures – Standard Call Outs.)

b. Cost: Although building a Simulator may be expensive, it is very affordable when compared to making new planes. For aircraft crew training, fuel usage can be stored while using a flight simulator. Finally all cost security is profitable, allowing companies to store millions of potential disability planes or mistakes from the lack of human experience. Memorize some Memory Items for Emergency dan QRH.

c. Skill: Flight Simulator allows simulated motion for aircraft, adopting a set of aerodynamics derived from general aircraft of the literature, in turbulent airflow and in case of engine failure in aircraft up to five engines. Simulated studies ensure that the aircraft retains equilibrium and of course in critical situations, as mentioned above. So that pilots can understand and deal with emergencies while operating a real plane.

2.3. Aviation Safety

Aviation safety is a condition for the safe use of airspace, aircraft, airports, air transport, flight navigation and support facilities and other public facilities. Undang-Undang Nomor 1 Tahun 2009 tentang Penerbangan dan Peraturan Menteri Perhubungan Nomor KM.24 Tahun 2009 tentang (Civil Aviation Safety Regulation Part139) tentang Bandar Udara (Aerodrome) Has arranged that safety
supervision of airport operations must be carried out in order to realize the operation of airports that meet flight safety standards. National Aviation Safety Preservation is one of the construction functions responsible for ensuring compliance with related standards, procedures and regulations by the Directorate-General for Air Transportation in order to ensure compliance with the regulations and provisions of aviation safety standards in general and the safety of Banda air operations, in particular by the airport orga. This intention is to make the implementation of airport operations safety monitoring used as a reference guideline for airport operations safety control in an effort to comply with airport security regulations.

According to the study's purpose and objectives, the study scope includes the following activities [3]:

a. Inventory of legal regulations relating to the safety of airport operations
b. Identification of airport operation types
c. Inventory of data and information related to airport operation safety
d. Analysis and evaluation
e. Recommendation

In order to set the safety performance target, it is necessary first appropriate safety performance indicators. Safety Performance indicators generally expressed in the frequency of events resulting in some damage. Safety performance indicators that can be used for example [4]:

a. Aircraft accidents per 10 000 aircraft movements
b. Fatal aircraft accidents per year
c. Serious incidents per 10 000 movements

3. Research Method

This research is based on the condition of one variable to another variable in the sense of whether the variable affects each other aimed at this research.

This research is a descriptive study using methods of quantitative research. Descriptive research is a research that leads to the disclosure of a problem or circumstance as it is and reveals the facts that exist, though sometimes given interpretation or analysis [5]. Quantitative research method is a research method based on the philosophy of positivity used to examine certain populations or samples, data compilation using research instruments, data analysis is quantitative or statistics with the objective of testing a numeric hypothesis [6].

The study used multiple regression methods to determine whether the maintenance factor system and the flight simulator had a significant impact on aviation safety.

4. Result and Discussion

4.1. Effect of Maintenance System (X1) and Simulator Pilot (X2) to Aviation Safety (Y) in partial

**Table 1.** The influence of maintenance system and simulator pilot on aviation safety

| Coefficients a |
|----------------|
| Model         | Unstandardized Coefficients | Standardized Coefficients | t     | Sig.    |
|               | B                        | Std. Error               | Beta  |        |
| 1             | (Constant)               | .754                     | .522  | 1.442   | .153    |
|               | maintenance system      | .383                     | .121  | 3.170   | .002    |
|               | simulator pilot         | .398                     | .112  | 3.561   | .001    |

**Table 1.** The influence of maintenance system and simulator pilot on aviation safety

1. Similarity of regression multiple linear

From the table we can see similarity of regression multiple linear, as follow:

a. The constant value (a) is 0.754 stating that if there is no change in the value of the maintenance
system variable and simulator pilot, the the value of the aviation safety is 0.754.

b. The coefficient predictor of maintenance system (X1) is 0.383, which means that maintenance system has a positive affect on aviation safety. If there is a change in maintenance system, there will be an increase in aviation safety of 0.383.

c. The coefficient predictor of simulator pilot (X2) is 0.398 which means that simulator pilot has a positive effect on aviation safety. If the simulator pilot is increased in aviation safety, there will be an increase in aviation safety of 0.398

2. Hypothesis Test in Partial (t test)

test (t) is carried out to determine the effect of each or independent (maintenance system and simulator pilot) on the dependent variable (aviation safety). This test can be carried out with the following conditions:

a. Effect of Maintenance System (X1) to Aviation Safety (Y)

The partial result (t test) between a maintenance variable to aviation safety with the $\alpha = 0.05$ significant certain, and $dk = n-2 = 94 - 2 = 92$. From that certain obtained number $t_{table} = 1.986$ and $t_{count}$ value is 3.170 with level significant is 0.002.

Then:

$t_{count} > t_{table}$ or 3.170 > 1.986, then $Ho$ is rejected and $Ha$ is accepted and 0.05 > $sig$ or 0.002 < 0.05, then $Ho$ is rejected and $Ha$ is accepted. So that conclusion is variable maintenance system (X1) significantly influence to aviation safety (Y).

b. Effect of Simulator Pilot (X2) to Aviation Safety (Y)

The partial result (t test) between a maintenance variable to aviation safety with the $\alpha = 0.1$ significant certain, and $dk = n-2 = 94 - 2 = 92$. From that certain obtained number $t_{table} = 1.986$ and $t_{count}$ value is 3.561 with level significant is 0.001.

Then:

$t_{count} > t_{table}$ or 3.561 > 1.986, then $Ho$ is rejected and $Ha$ is accepted and 0.05 > $sig$ or 0.001 < 0.05, then $Ho$ is rejected and $Ha$ is accepted. So that conclusion is variable maintenance system (X1) significantly influence to aviation safety (Y).

4.2. Effect of Maintainance System (X1) and Simulator Pilot (X2) to Aviation Safety (Y) in parsial in Consolidation

Table 2. Parsial in Consolidation

| Model     | Sum of Squares | Df | Mean Square | F    | Sig.  |
|-----------|----------------|----|-------------|------|-------|
| Regression| 21,804         | 2  | 10,902      | 16.690 | .000* |
| Residual  | 59,441         | 91 | .653        |       |       |
| Total     | 81,245         | 93 |             |       |       |

From the results of the above table, $F = 16.690$. 0.000 < 0.05 $Ho$ rejected, thus having a positive maintainance system, simulator pilot on aviation safety.

It is known that the calculated F value is 16.690. Because the value of $F_{count} 16.690 > F_{table} 3.10$, it can be concluded that the hypothesis is accepted or Maintenance System (X1) and Simulator Pilot (X2) are falling on the Intention of Aviation Safety (Y)
4.3. Correlation Between Maintenance System (X1) and Simulator Pilot (X2) to Aviation Safety (Y)

Table 3. Correlation

|       | X1       | X2       | Y        |
|-------|----------|----------|----------|
| **X1** Pearson Correlation | 1        | .713**   | .722**   |
| Sig. (2-tailed) |          | .000     | .000     |
| N      | 92       | 92       | 92       |
| **X2** Pearson Correlation | .713**   | 1        | .578**   |
| Sig. (2-tailed) |          | .000     | .000     |
| N      | 92       | 92       | 92       |
| **Y** Pearson Correlation | .722**   | .578**   | 1        |
| Sig. (2-tailed) |          | .000     | .000     |
| N      | 92       | 92       | 92       |

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation between maintenance system and aviation safety is $R = 0.722$, which can be seen with the correlation interpretation table if the value $0.60 - 0.799$ has a strength correlation between $X_1$ and $Y$ have a strength correlate. Based on the acquisition of calculations that the findings acquired from the spss are 0.722, this indicates that the maintenance system implementation of aviation safety have a strength correlate and positive to aviation safety. Can be concluded maintenance system can increase if engineer do maintenance schedule in the right time.

The correlation between simulator pilot and aviation safety is $R = 0.578$, which can be seen with the correlation interpretation table if the value $0.40 - 0.599$ has an average correlation between $X_2$ and $Y$ have an average correlate. Based on the acquisition of calculations that the findings acquired from the spss are 0.578, this indicates that the simulator pilot implementation of aviation safety have an average correlate and positive to simulator pilot. Can be concluded simulator pilot can increase if pilot conducted simulator pilot.

Table 4. Model Summary

| Model | R     | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------|----------|-------------------|---------------------------|
| 1     | .518a | .268     | .252              | .808                      |

a. Predictors: (Constant), simulator pilot, maintanance system

From the result of the above table, r value for $X_1$ and $X_2$ is 0.518 that point can use to see how average correlation between maintennace system and simulator pilot to aviation safety, interpretation of the strength of the correlation can see from the following table:

- 0.00-0.199 very weak
- 0.20-0.399 weak
- 0.40-0.599 average
- 0.60-0.799 strength
- 0.80-1.000 very strength

Based on correlation table maintennace sytem has the highest percentage of other variables. Compared to the variable $X_2$ and simultaneous correlation
5. Conclusion and Managerial Implication

From the subject matter of the research that has been submitted, some conclusions can be drawn from the topic of the presented studies, based on the data analysis that has been discussed and indicated in the past section. That is:

From the subject matter of the research that has been submitted, some conclusions can be drawn from the topic of presented studies, based on the data analysis that has been discussed and indicated in the past section. That is:

1. Effect of Maintenance System (X1) and Simulator Pilot (X2) partly on Aviation Safety (Y)
   a. Linear Equation Multiple Regression
      \[ Y = 0.754 + 0.383X1 + 0.398X2 \]
      Constant value (a) is 0.754 meaning that if there is no change in the value (constant) of the maintenance system and simulator pilot, then the value of the aviation safety is 0.754. The maintenance system coefficient (X) 0.383, which means that if there is a change in maintenance system of one unit, then there will be an increase in the aviation safety of 0.383. Flight Simulator coefficient value (X), of 0.398 means that if the simulator pilot is increased by one unit, then there will be an increase in aviation safety of 0.383.
   b. Based on the partial analysis (t test), it turns out that the results of the study how that all the independent variables partially have a significant effect of the dependent variable with the acquisition of the calculation results as follow:
      1. Maintenance System variables have the results of tcount > ttable or 3.170 > 1.660 and 0.1 > sig or 0.1 > 0.002 then Ho is rejected and Ha is accepted, meaning that it can be said that maintenance system has a significant influence on aviation safety.
      2. Simulator Pilot variables have the results of tcount > ttable or 3.561 > 1.660 and 0.1 > sig or 0.1 > 0.001 then Ho is rejected and Ha is accepted, meaning that it can be said that simulator pilot has a significant influence on aviation safety.

2. Effect of Maintenance System (X1) and Simulator Pilot (X2) partly on Aviation Safety (Y) in combination. Based on simultaneous testing (Test F), it turns out the results of the study prove that all the independent variables combined have a significant effect on the dependent variable with the acquisition of results F count> F table or 16.690> 3.10 then Ho is rejected Ha accepted.

3. Correlation between Maintenance System (X1) and Simulator Pilot (X2) to Aviation Safety (Y)
   Based on the results of correlation testing, R is obtained at 0.518 That is, the two independent variables have a relationship and an average influence on the aviation safety, with a coefficient of determination of 26.8% which means the maintenance system variable and simulator pilot has a contribution of 26.8%, while the remaining 73.8% is influenced by other variables outside of maintenance system and simulator pilot. Based on correlation table maintenance system has the highest percentage of other variables. Compared to the variable X2 and simultaneous correlation with the result is 0.722.

6. References
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