ANALYSIS OF HUMAN FACTORS IN RUNWAY EXCURSION EVENTS IN THE PAPUA REGION FOR THE PERIOD 2013 TO 2023

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ABSTRACT
This research aims to analyze the human factors contributing to *runway excursion* incidents in the Papua region during the period from 2013 to 2023. *Runway excursion* incidents involve situations where an aircraft exceeds the *runway* limits during landing or takeoff and have become a serious concern in the aviation industry. The methodology involves the analysis of accident and aviation incident data that occurred in the Papua region during the specified period. The data encompass information related to human factors, such as pilot errors, ground staff, and other human-related factors that may influence *runway excursion* incidents. Additionally, this study will also consider environmental and technical factors that could play a role in these incidents. The results of this analysis will provide deeper insights into the primary causes of runway excursion incidents in the Papua region, with a specific focus on human aspects. With a better understanding of these factors, it is expected that more effective preventive measures and recommendations can be implemented to enhance aviation safety in the region.

Keywords: *Human Factor, Runway Excursion, Papua.*

1. INTRODUCTION

The aviation industry is one of the most important sectors in global mobility, connecting remote locations with economic and cultural centers around the world. The Papua region, with its challenging terrain and extreme weather, is one of the regions of the world where aviation safety is a major focus. Over the past decade, there have been serious concerns related to *runway excursion* events in the Papua region.

Runway excursion is a common type of landing accident. This situation occurs when an aircraft exits the runway, either by turning sideways or by crossing the end of the runway, resulting in the aircraft exiting the runway. The aircraft exits because it cannot stop after reaching the end of the runway [1].

Runway Excursion can be caused by several things including those related to aircrew techniques and decisions, weather, aircrew performance, system-related factors, runway conditions, braking systems and many others [2].

Based on the data obtained, it was recorded that there were 62 incidents/accidents, and as many as 40 of them were *runway excursion* incidents, Referring to these data it can be concluded that *runway excursion* incidents dominate with more than 50% of the total number of incidents/accidents that occurred in the Papua Region [3] [4] [5] [6] [7] [8] [9] [10] [11] [12].

Papua has unique geographical characteristics with many airports located in mountainous areas and valleys surrounded by tropical rainforests. The often extreme weather conditions and limited infrastructure add greater challenges to flight operations in this region. Therefore, it is important to investigate how human factors, such as pilot decision-making, team communication and training, can influence the occurrence of *runway excursion*s in this already complicated environment.

2. METHOD

The method used in this research is using qualitative methods. Qualitative research is a research process that produces descriptive data in the form of written or spoken words from people and observable behavior [13]. I Made Winarta explains that the qualitative descriptive analysis method is a method that

contains a process of analyzing, describing and summarizing various conditions taken from a collection of information derived from interviews or direct observations in the field of the problem being studied.

The data collection method used in the article is to use the literature review method. Literature review means a review of all literature related to the research (review of related literature). This is done with the aim of being able to review the correlation between the literature and the problem being studied [14]. In collecting data using secondary data derived from the *final report* of the investigation results of the National Transportation Safety Commission during the period 2013 to 2023, from a total of 40 NTSC investigation reports, there are 9 reports that have been completed to produce a *final report* and are related to the *runway excursion* incident and the rest are only at the preliminary report stage. So the author analyzed the 9 reports.

The Human Factors Analysis and Classification System (HFACS) was developed by Dr. Scott Shappell and Dr. Doug Wiegmann. It is a broad human error framework originally used by the United States Air Force to investigate and analyze human factors in aviation. HFACS is heavily based on James Reason's *swiss cheese* model [15].

The HFACS framework provides tools to assist in the investigation process and direct training and prevention efforts. Investigators can systematically identify active and latent failures in an organization that lead to accidents. The goal of HFACS is not to assign blame; the goal is to understand the causal factors underlying the accident.

Table 1. List of Runway Excursion Events in Papua Region from 2013 to 2023.

The HFSCS framework consists of 4 levels which include:

1. *HFACS Level 1: Unsafe Acts;*
2. *HFACS Level 2: Preconditions for Unsafe Acts;*
3. *HFACS Level 3: Unsafe Supervision;*
4. *HFACS Level 4: Organizational Influences.*

3. RESULT AND DISCUSSION

Runway excursion incidents that cause losses both in terms of material and casualties are shown in the table below.

No	Type, Year, Location of Event	Description
1.	PK-UCJ, 17 Jan 2013, Wamena, Papua	Pilatus Porter PC-6 operated by Yayasan Jasa Aviasi Indonesia experienced a *veer off* during landing with slippery runway conditions due to puddles resulting from rain 20 minutes before the incident and rubber deposits on the runway.
2.	PK-YRF, 5 Feb 2013, Apalapsili, Papua	DHC 6-300 operated by PT Trigana Air Service experienced skidding which then the pilot tried to recover but failed, causing the aircraft to exit the runway and stop 500 m from the end of the runway, one of the causes is that the pilot is not familiar with the area.
3.	PK-DGI, 31 Mei 2013, Wamena, Papua	Bae ATP *Freighter* operated by PT Deraya experienced a veer off and stopped 10 meters to the left of the *runway shoulder* due to unstable aircraft during the *approach*.
4.	PK-RSP, 14 Nov 2013, Nalca Airstrip, Papua	The Cessna C20B operated by PT Enggang Air Service landed on runway 24 and 20 meters before the parking area the right wheel mired on the *soft runway,* causing the aircraft to tilt to the right. There were no casualties in the incident.

5.	PK-BBS, 24 Oct 2014, Wamena, Papua	Boeing 737-300 freighter operated by PT Cardig Air experienced a *serious incident*. When landing roll failed to stop before the end of the runway so that it entered the runway end safety area causing damage to both engine blades and the left *horizontal stabilizer*.
6.	PK-RSC, 9 Sept 2014, Mulia Airport, Papua	The Cessna C208B operated by PT Enggang Air Service experienced *bouncing* during landing and exited the runway to the left, this was caused by an illusion on the runway that made the pilot misinterpret the runway conditions.
7.	PK-BBY, 28 Agt 2015, Wamena, Papua	Boeing 737-300 *freighter* landed with 3,683 G which caused the landing gear to break so that the fuselage rubbed against the runway, the aircraft stopped 1500m from the runway threshold, no one was injured in this incident.
8.	PK-UAG, 3 Feb 2016, Siriwo Area, Enarotali, Papua	A Bell 206L-4 helicopter operated by PT Amur Aviation Indonesia experienced spinning during landing which the pilot failed to recover, causing the helicopter to exit the landing area and hit a nearby building.
9.	PK-YSY, 13 Sept 2016, Wamena, Papua	Boeing 737 operated by Trigana Air Service suffered a broken landing gear which caused the aircraft to veer off course, 3 people suffered minor injuries.

By using the HFACS framework to analyze the causes of incidents, organizations can identify deficiencies in the entire system that lead to incidents. HFACS can also be used proactively by analyzing incident history to identify recurring trends in human performance and deficiencies in a work system.

HFACS provides a structure for reviewing and analyzing historical accident and safety data. By outlining the human contribution to performance, it then allows analysts to identify the underlying factors associated with unsafe acts. The HFACS framework can also be useful as a guide for conducting investigations into future accidents and for developing better accident databases, both of which will improve the overall quality and accessibility of human factors accident data. Common trends in an organization can be drawn from a comparison of the psychological origins of unsafe acts, or from the latent conditions that enable these acts in the organization. Identifying such common trends supports the identification and prioritization of where interventions are needed in an organization. By using HFACS, an organization can identify where hazards have arisen and implement procedures to prevent these hazards that will result in improved personnel performance and reduced accident and injury rates.

The first level of the HFACS framework is about Unsafe Acts. Unsafe Acts are divided into two categories, errors and violations and these two categories are then further divided into subcategories. Errors are unintentional behaviors, while violations are deliberate acts of ignoring rules and regulations.

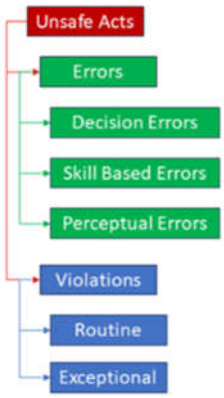

Figure 1 Unsafe Acts Frame Work

Table 2. Incidents caused by *unsafe* act factors

Aircraft Type	Event Description	*Error* Type
PK-UCJ	The pilot failed to do *recovery* when the airplane made a poorly positioned landing.	*skill based error*
PK-YRF	The pilot was not familiar with the airport conditions, causing a difference in perception between the PIC and SIC. Then the PIC's decision to do *recovery* the aircraft condition is not in accordance with the technique that should be used.	*perceptual errors, skill based error*
PK-DGI	The aircraft did not experience instability in the *approach*. And the *recovery* performed by the pilot when the aircraft lands is not in accordance with the direction of the runway that should be, not in accordance with the *Approach and Landing Accident Reduction* Tool Kit.	*perceptual errors, skill based error*
PK-BBS	*Approaches* are made when weather conditions are brought to the minimum standard for VFR, and based on the Company's SOP requires a return to the airport of origin.	*Exceptional violation*
PK-BBY	The pilot was unaware of the *windshear*, causing the aircraft to land with considerable *impact*.	*perceptual errors*
PK-YSY	The aircraft experienced an *unstabilized approach* and was determined to continue landing..	*perceptual errors*

The second level of the HFACS framework is *Preconditions for Unsafe Acts*. *Preconditions for Unsafe Acts* are divided into three categories, environmental factors, operator conditions, and personal factors, and these two categories are further divided into subcategories. Environmental factors refer to physical and technological factors that affect individual practices, conditions and actions and result in *human errors* or unsafe situations. Operator conditions refer to poor mental state, poor physical state, and physical/mental limitation factors that affect individual practices, conditions, or actions and result in *human errors* or unsafe situations. *Personal factors refer to Team Resource Management (TRM)* and personal readiness factors that affect an individual's practices, conditions or actions and result in human errors or unsafe situations.

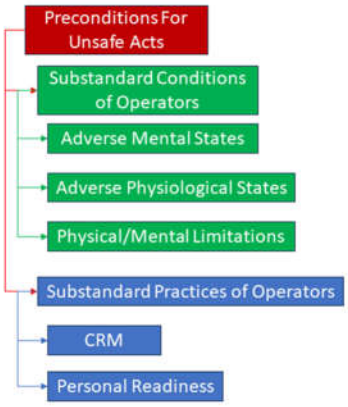

Figure 2 *Preconditions for Unsafe Acts Framework*

Tabel 3. Incidents caused by *unsafe act* factors

Aircraft Type	Event Description	*Error* Type
PK-UCJ	There is no *approach and landing crew briefing* when making an *approach*.	CRM
PK-YRF	The PIC and SIC had different perceptions of the aircraft's position relative to the runway centerline during the *final approach* phase.	CRM

PK-YSY	During the *approach*, PM reminded PF that the aircraft was too high while at about 1,000 ft AGL, PM suggested a *go-around* but PF did not follow it.	CRM

The third level of HFACS framework is Unsafe Supervision which is divided into 4 categories, namely *inadequate supervision, planned inappropriate operations, failed to correct the problem, and supervisory violation*, as shown below.

Figure 3 Unsafe Supervision Framework.

The fourth level of the HFACS framework is *Organizational Influences* which is divided into 3 categories namely *Resource Management, Organizational Climate,* and *Organizational Process* as shown below.

Figure 4 Organisational Influences Framework.

4. CONCLUSION

Based on the analysis of the KNKT report, it can be concluded that 6 out of 9 *runway excursion* incidents in the Papua region were caused by human error and 3 out of 9 *runway excursion* incidents in the Papua region were caused by factors from communication problems, team coordination, planning, and teamwork. Human factor issues in their influence on incident and accident cases. This is supported by the desire to improve industrial safety by all means necessary. Regarding the common belief that most incidents and accidents are caused by human error, the review identified some evidence. However, little evidence was found in the sample of scientific literature reviewed. Nonetheless, it should be noted that absence of evidence is not evidence of absence. Such evidence may exist outside the research sample used in this study. In this case, the figures have not undergone rigorous verification, and the phenomenon is far more complex than can be solved with such a simple answer.

AUTHORS' CONTRIBUTIONS

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ACKNOWLEDGMENTS

The title "ACKNOWLEDGMENTS" should be in all caps and should be placed above the references. The references should be consistent within the article and follow the same style. List all the references with full details.

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