THESIS

THE SIMILAR CALLSIGNS USED IN VERBAL AIR GROUND COMMUNICATION: PROCEDURE AND RISKY PROBLEM AT MAKASSAR AIR TRAFFIC SERVICE CENTER

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Written and Submitted by

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States truthfully that this thesis was the result of my own words, and it is not the work of others. If its proven later that either some or entire part of this thesis is the work of others, I am will to accept any sanctions to my dishonesty

Makassar, 3 February 2021

GATUT NUGRAHA SUMARNANTO BUDHI

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ABSTRACT

GATUT NUGRAHA SUMARNANTO BUDHI. The Similar Callsigns Used in Verbal Air Ground Communication: Procedure and Risky Problem at Makassar Air Traffic Service Center (Under supervised by Fathu Rahman and Sukmawaty).

This study aims to discuss Air-Ground Communication as a special means of communication that aims to facilitate the interaction between Air Traffic Controllers and Pilots for safe and efficient flight operation. Pilots are responsible for flying the aircraft and the air traffic controllers (ATC) are responsible for providing information and standard separation of all flights under ATC's area of responsibility or jurisdiction. The objectives of this study are 1) to describe the kind of similar callsign in aviation, especially in Makassar Air Traffic Service Center, and 2) to provide a procedure to minimize the risk of similar callsign or callsign confusion. The method used in this research was a combination of quantitative and qualitative. This research is supported by Ground Criteria Theory (GTC). Data were collected from MATSC's Flight Data Recording System and interview with pilots and active air traffic controllers. The success of air-ground communication will be demonstrated by the acceptable level of safety. Many problems are involved in miscommunication, namely similar callsigns. It is important to make sure that the correct callsign is used. If a similar callsign aircraft operates on the same radio frequency, it could result in one pilot executing a clearance designated for another aircraft due to improper use of the callsign. The result of the research shows that similar callsign is one of the hazard identification in aviation. This thesis provides preliminary information regarding the current conditions of the possibility of a similar callsign at Makassar Air Traffic Service Center. The implication of this research raises the awareness of the importance of standardized operational system.

Keywords: skychats, communication, callsign, aviation

ABSTRAK

GATUT NUGRAHA SUMARNANTO BUDHI. Kajian tentang Penggunaan Callsign Serupa dalam Komunikasi Verbal Udara Darat: Prosedur dan Masalah Risiko di Pusat Pelayanan Lalu Lintas Penerbangan Makassar (dibimbing oleh Fathu Rahman and Sukmawaty).

Penelitian ini bertujuan membahas Air-Ground Communication sebagai sarana komunikasi khusus yang bertujuan untuk mefasilitasi interaksi antara Air Traffic Controllers dengan Pilot untuk operasi penerbangan yang aman dan efisien. Pilot bertanggung jawab untuk menerbangkan pesawat dan pengawas lalu lintas udara (ATC) bertanggung jawab untuk memberikan informasi dan pemisahan standar dari semua penerbangan di bawah wilayah tanggung jawab atau yurisdiksi ATC. Tujuan dari penelitian ini adalah 1) untuk mendeskripsikan jenis callsign yang mirip dalam penerbangan, khususnya di Pusat Pelayanan Lalu Lintas Penerbangan Makassar. 2) memberikan prosedur untuk meminimalkan resiko kebingungan callsign atau callsign sejenis. Metode yang digunakan dalam penelitian ini adalah kombinasi antara kuantitatif dan kualitatif. Penelitian ini didasari oleh *Ground Criteria Theory* (GTC). Data diperoleh dari system rekam data penerbangan yang berada di MATSC. Keberhasilan komunikasi udara-darat akan ditunjukkan oleh tingkat keamanan yang dapat diterima. Banyak masalah yang terlibat dalam miskomunikasi, yaitu tanda panggilan serupa. Penting untuk memastikan bahwa callsign yang digunakan benar. Jika pesawat tanda panggil serupa beroperasi pada frekuensi radio yang sama dapat mengakibatkan satu pilot melaksanakan izin atau perintah yang ditujukan untuk pesawat lain karena penggunaan tanda panggil yang tidak tepat. Hasil dari penelitian ini menunjukkan bahwa panggilan serupa atau mirip merupakan salah satu dari potensi bahaya di penerbangan. Thesis ini memberikan informasi awal mengenai kondisi terkini terkait kemungkinan callsign serupa di Makassar Air Traffic Service Center. Implikasi dari penelitian ini menumbuhkan kesadaran akan pentingnya system operasional yang terstandarisasi

Kata kunci: skychats, komunikasi, callsign, penerbangan

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CHAPTER I
INTRODUCTION

A. Background of the Research

Communication is an essential key to organizational, managerial performance and success, efforts to achieve goals of activities or program, including the aviation environment. Miscommunication from a linguistic perspective is a mismatch between the message intended by the speaker and the message processed by the hearer, whether it is the result of errors in understanding or errors in production. Looking more closely at what can go wrong in aviation communication from a linguistic perspective, it is important to first note that miscommunication can occur at all levels of linguistic analysis and representation. All the way from the speech signal and phonology to lexical and syntactic choices, as well as from the interaction of prosody with Syntax and Semantics (Cushing, 1994)

Effective communication is a basic human need, and in operational flight, communication is a prerequisite for flight safety. If the aviation industry can find solutions to all of these communication problems, airlines will be trouble free. However, due to the fact that human are still operators and tend to make mistakes, human factors will still exist. Again, the successful application of the recommended solutions discussed below can help minimize existing communication problems. Therefore, the importance of communication can be optimized.

The important way of communicating in the operational context of aviation between Air Traffic Controller (ATC) and pilots, management and operational personnel is the ability to communicate effectively will help reduce aviation accidents. Verbal communication is one of the main means of communication in the operational context of aviation and should be improved throughout the practice of all

employees. According to many reports, miscommunication between ATC and pilots is one of the major contributing factors to aviation disasters, so it should be considered with great concern. Communication breakdown may result from callsign confusing or similar callsign.

In Supporting European Aviation especially in Callsign Similarity Service (https://www.eurocontrol.int/service/call-sign-similarity-service), it is mentioned that the use of similar callsigns by aircraft operating in the same area on the same radio frequency is referred to as 'callsign similarity'. The danger of a pilot taking and acting on a clearance intended for another aircraft due to this phenomenon is a common occurrence and can lead to flight safety incidents. The purpose of the callsign similarity service is to help aircraft operators (AOs) to de-conflict similar callsigns embedded in their schedules. This helps to reduce the incidence of callsign confusion events and improves the safety of the Network.

In addition, in the service levels, the Call Sign Management Cell (CSMC), as part of the Network Manager Operations Center (NMOC), delivers three levels of services. They are as follows;

1. Service level 0. The main objective is to raise awareness about CSS reduction processes. In particular this involves providing the following: a) publication of the CSS rules to be applied in the process of detection and resolution of conflicts; b) support aircraft operators (AOs) in implementing callsign similarity reduction processes; and c) provide feedback and monitor the results of the implementation and of the use of the de-confliction strategies during the season.

2. Service level 1. Service Level 1 provides support to de-conflict or eliminate similar callsigns within a single aircraft operator's schedule, prior to the start of the summer and winter season. The CSMC facilitates and monitors this process with the help of

the Call Sign Similarity Tool (CSST). As part of this service level, the CSMC also provides users with a limited feedback on priority conflicts with other CSST users.

3. Service level 2. This level 2 will provide support to de-conflict or eliminate similar callsigns between different aircraft operators' schedules, prior to the start of the summer and winter season. This service level will be dependent on the success of Service level 1 operations.

According to Skybrary (https://www.skybrary.aero/index.php/Call-sign_ Confusion) the use of similar callsigns by aircraft operating in the same area and especially on the same RTF frequency often gives rise to potential and actual flight safety incidents. This hazard is usually referred to as "callsign confusion". The following are some examples of the more common causes for callsign confusion: a) Airlines allocate commercial flight numbers as callsigns; these are normally consecutive and therefore similar (e.g. RUSHAIR 1431, RUSHAIR 1432, etc.), b) Airlines schedule flights with similar callsigns to be in the same airspace at the same time, c) Callsigns coincidentally contain the same alphanumeric characters in a different order (e.g. AB1234 and BA 2314), d) Callsigns contain repeated digits (e.g. RUSHAIR 555), and e) Alpha-numeric callsigns end in two letters which correspond to the last two letters of the destination's ICAO location indicator (e.g. RUSHAIR 25LL for a flight inbound to London Heathrow). Maintaining communication between pilot and ATC, it is supposed to use the plain language.

Plain language, when combined with other good communication skills, helps to increase accurate communication of pertinent information. By incorporating an iterative "feedback loop" into important or critical communications, you can dramatically improve understanding and retention of spoken and written word. Simply ask the listener or reader to repeat back his or her understanding of the

communication in his or her own words to ensure that the correct information has been received and remembered. And when in doubt, recall the words of Academy Award winning screen writer Charlie Kaufman: “Constantly talking isn’t necessarily communicating.” (Michael Lewis, 2020)

Callsign and Air Ground Communication

An ATC in charge is based on processing information provided in aural both visual and written forms. Of the most skills needed by an ATC, there are two of the most important ones, namely: 1) the ability to communicate, and 2) the ability to receive and spread information.

Every ATC job requires some verbal communication including information spoken to the controller by the pilot or vice versa. Almost all of them are very dynamic information, such as separation between planes in flight traffic and information on avoiding bad weather and changing information from flight plans to radio media. Hamilton (1991) has written, “a system is only as reliable as its weakest link and it can be said with reasonable confidence that the weakest link in the aviation system is the human component”.

Humans contribute to the flexibility needed in the air traffic system but do not rule out the possibility that humans can make mistakes either made by ATC officers or pilots that can cause serious events. The method used to protect pilots and ATC officers from errors caused by humans and an operational system in communication is the standardization of communication procedures.

There is an argument for having stricter procedures for communicating information than those for operating hardware (Byron, 1997), since the human

involvement in communication is greater and, in air traffic control, requires ‘double-handling’ where errors can occur at either end.

The content, structure, dialogue, vocabulary, and sequences in aviation traffic communication are normally standardized by ICAO to avoid ambiguity and the potential for errors. There are 4 steps in communication techniques according to ICAO regulations to close the occurrence of repeated loops or errors (closed loop)

1. the sender transmits a message, with format
    a. Callsign (aircraft/station identification)
    b. Content of messages (instruction, clearance or information)
2. the receiver actively listens to the message
3. the receiver repeats the message back to the sender, with format
    a. content of messages
    b. Callsigns
4. the sender actively listens for the correct readback (hearback), for example:

    ATC : *“BTK6213 (Batik Air six two one three), turn left heading 270 (two seven zero) vectoring for intercept 10 (one zero) miles final course”*

    Pilot : *“Turn left heading 270 (two seven zero) vectoring for intercept 10 (one zero) miles final course, BTK6213 (Batik Air six two one three)”*

    (Shawcross and Beaumont as cited by Bartsch, 1996: 192)

From the conversation it seems that the duty of an ATC in controlling or regulating flight traffic is expressed as "to take reasonable care to give all such instructions and advice as may be necessary to promote the safety of aircraft within their area of responsibility". This service task arises when there is a link between the ATC and the Pilot that is determined by the level of trust in the responsibility of the task. The pilot is legally responsible for the safety of the aircraft and its passengers. The ATC is legally responsible for the safety of air traffic control instructions.

The use of similar callsign by aircraft operating in the same area jurisdiction of Air Traffic Service, and in particular at the same radio frequency, often leads to potential and actual flight safety incidents. This danger is usually referred to as "confusion with the callsign". The following are some examples of the more common causes for callsign confusion:

a. Airlines allocate commercial flight numbers as callsigns; these are normally consecutive and therefore similar (e.g. BATIK 6672 - BATIK 6762, LION 762 – LION 782 etc.)

b. Airlines schedule flights with similar callsigns to be in the same airspace at the same time. (e.g. GARUDA 662 – LION 662, WINGS 1302 – ALPHA 1302)

c. Callsigns coincidentally contain the same alphanumeric characters in a different order (e.g. AB1234 and BA 2314).
d. Callsigns contain repeated digits (e.g. LION 777).

Based on fact, the effects of similar callsign may cause some problems as follows:

a. Loss of Communication
   The pilot misses a instruction because of a blocked transmission by other station with a similar callsign.
b. Loss of Separation
   A defined loss of separation between airborne aircraft occurs whenever specified separation minima in controlled airspace are breached. Minimum separation standards for airspace are specified by ATS authorities, based on ICAO standards.
c. Level Bust
   Defined as any unauthorised vertical deviation of more than 300 feet from an ATC flight clearance.
d. AIRPROX
   A situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised. (ICAO Doc 4444: PANS-ATM).
e. Midair Collision
   An accident where two aircraft come into contact with each other while both are in flight.

Chicago Midway Airport (MDW), June, 16, 2015 between Delta 1328 (DAL1328) and Southwest 3828 (SWA3828) that took off from different runways but headed for an intersection point on runway.

MDW Ground	:	*Delta 1328, be advised similar callsign on frequency is Southwest 3828 Cross runway 31 Charlie and runway 31 Left, taxi via Yankee to 4 Right.*
DAL 1328	:	*We're cleared to cross 31 Charlie and 31 Left, Yankee to 4 Right, Delta 1328,we'll be aware*
MDW Ground	:	*Southwest 3828, be advised similar callsign on frequency is Delta 1328. And once you approach 31 Right as you're crossing it, you can switch over the Tower. Have a good day.*
SWA 3828	:	*Áight! We'll be listening to that and switching over the Tower as we approach 31 Right, Southwest 3828.*
MDW TWR	:	*Delta 1328, Midway Tower. Traffic holding in position on the crossed runway. Traffic on 4 miles final landing on your parallel. And traffic on 10 miles final, 4 Right line up and wait.*
DAL 1328	:	*Line up and wait 4 Right, Delta 1328*
MDN TWR	:	*Southwest 3828, Midway Tower. Runway 31 Charlie line up and wait.*
SWA 3828	:	*31 Charlie, line up and wait, Southwest 3828.*
MDW TWR	:	*Southwest 3828, traffic holding on position crossed runway. Traffic on 2 miles final for the crossed runway. No delay, please!* *Turn left heading 250, Runway 31 Charlie, Cleared for take-off, the wind 060 at 9*
SWA 3828	:	*[BLOCKED] supposedly Delta and Southwest are transmitting at same time.*
MDW TWR	:	*You called at once. Southwest 3828, just verify no delay, left to 250. 31 Charlie cleared for takeoff.*
SWA 3828	:	*[BLOCKED] cleared for takeoff 31 Charlie, no delay, heading 250, Southwest 3828.*
MDW TWR	:	*Delta 1328, STOP! STOP! STOP!*
DAL 1328	:	*We're stopping*
MDW TWR	:	*Delta 1328, make the right turn onto taxiway Delta, right turn on Delta. Hold short runway 4 Right*
SWA 3828	:	*[Delta Blocking]….hold short of 4 Right*
MDW TWR	:	*…for each other, Southwest 3828 and Delta 1328….* *Southwest 3828, make the right turn onto Golf back taxi runway 31 Charlie.*
SWA 3828	:	*Right turn on Golf, back taxi 31 Charlie. We're gonna need to stop on taxiway.*
SWA 3828	:	*Southwest 3828, can we stop here?*
MDW TWR	:	*…3828, affirm. Did you get hot breaks?*
SWA 3828	:	*….we're gotta check that.*
MDW TWR	:	*Aight! Just let we know!* *…you gonna be good to go?*

SWA 3828 : *Southwest 3828.*
SWA 3828 : *Southwes 3828?*
MDW TWR : *Go ahead, sir?*
SWA 3828 : *Yeaah, we're Southwest from 31 Charlie, were the ones cleared for takeoff?*
MDW TWR : *Yes, sir, you were. You were the one. You were doing what what you supposed to be doing.*
SWA 3828 : *Then Delta….was rolling also?*
MDW TWR : *He took your callsign. Somebody cut stoppingon you and I couldn't figure out who it was. And then….and that's why I reiterated that it was you that I was clearing for take off*
SWA 3828 : *Okay, we just gotta run some numbers and contact company.*
MDW TWR : *Roger.*
DAL 1328 : *Delta 1328, something….we gotta call company*
MDW TWR : *Roger.*
DAL 1328 : *Kilo, Delta 13…or Yankee for Delta 1328?*
MDW TWR : *Delta 1328, if you can make the left turn into the Yankeepath and you can sit there as long as you need.*

Look at the following figure to see how the traffic of aircrafts have possible miscommunication or misunderstanding caused by similar callsign

Figure 1. The Similar Callsign Caused Misunderstanding

Look at the SWA2838 and DAL1328, as shown in Figure 1 above, have very close call when both aircraft started to roll. In this case, the similar callsign caused Delta pilot misunderstanding the Southwest take off clearance. Thus, the problem of

similar callsign in verbal air ground communication must be well-organized to avoid misunderstanding because it can pose a very fatal risk for flight control.

Similar Callsign and Its Problem

The following is about the similar callsign and its problem and the rule of ICAO Annex 10 chapter 5.2.1.7.2.1 in which the callsign must be one of the A, B, or C types (ICAO Council, 2001).

a). Flight number

In the aviation industry, a flight number or flight designator is a code for an airline service consisting of two airline identification characters and 1 to 4 digit numbers (IATA Passenger Glossary of Terms, 2018). A number of conventions have been developed to determine flight numbers, although these vary widely from airline to airline, and are increasingly being modified according to the rate at which aviation grows, (see Peter Newell, "Flight Numbering Alternatives", Ascend: A Magazine for Airline Executives, issue 2, 2014). Flights to the east and north traditionally use even numbers, while flights to the west and south have odd numbers. Other airlines will use the odd number for outgoing flights and use the next even number for the return flight.

For example: GIA603 (GA603) is the flight number for Garuda Indonesia aircraft for flights from Jakarta (CGK) to Makassar (UPG). Meanwhile, GIA604 (GA604) is a Garuda Indonesia flight with the aim of Makassar (UPG) to Jakarta (CGK). Flight numbers less than three digits are often used for long haul or premium flights. For example, flight number 1 is often used for airline "flagship" services or VVIP / VIP flights.

Four-digit numbers in the 3000 to 5999 range typically represent regional affiliated flights, while numbers greater than 6000 are generally codeshare numbers

for flights operated by airlines. Likewise, flight numbers greater than 9000 usually refer to ferry flights; it does not carry passengers and is used to move aircraft to or from a maintenance base, or from one air travel marketplace to another for starting new commercial flights. Flight numbers starting with 8 are often used for charter flights, but always depend on the choice of the commercial airline.

b). Callsign

Callsign is an airline marker or code established by the International Civil Aviation Organization (ICAO) which is used as a call in radio communication in accordance with the regulations contained in ICAO Document 8585: Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services. Most airlines use a callsign which is normally used during air-line radio transmissions (ICAO 8585, 2020).

In accordance with ICAO Annex 10 chapter 5.2.1.7.2.1, the callsign must be one of the following types:

Table 1. ICAO Annex 10 chapter 5.2.1.7.2.1, the Callsign Types

No	Type	Description
1	A	the characters corresponding to the registration marking of the aircraft
2	B	the telephony designator of the aircraft operating agency, followed by the last four characters of the registration marking of the aircraft.
3	C	the telephony designator of the aircraft operating agency, followed by the flight identification.

(adapted from Norrish 2001)

The most widely used in commercial aviation is C type. Flight identification is often found with the same flight number. This may have an impact on the mention of callsign by an Air Traffic Controller in an air ground communication (radio communication). Callsign confusion occurs when two or more flights with similar

flight numbers fly close together or in an area that uses one radio frequency, for example the KLM 645 and KLM 649 or Speedbird 446 and Speedbird 664.

The procedures for handling similar callsign have not been regulated successfully either nationally or internationally. This drives a condition in the absence of standards in each unit of aviation navigation service providers, especially in Indonesia. The procedure for handling similar callsign is very urgent to make because similar callsign is one of stating points as hazard identification which can cause breakdown of separation and even cause mid-air collision.

This research will study about air ground voice communication (similar callsign in verbal air ground communication) between air traffic controller and pilots, and it is especially to focus on similar callsign or callsign confusing which is potentially occurred in Makassar Air Traffic Service Center. This research is specifically to focus on similar callsign in verbal air ground communication: procedure and risky problem. The area of data taken is at Makassar Air Traffic Service Center.

B. Research Question

Related to the topic of this research, the problem statements as research questions are formulated in the following;

1. What are the kinds of similar callsign in verbal Air Ground Communication might cause the potential risk in Makassar Air Traffic Service Center?
2. How significant are needed to provide procedure to minimize the risk of similar callsign or callsign confusing?

C. Objectives of the Research

Based on the problem statements above, the objectives of this research are formulated as follows:

1. Describe the kind of similar callsign in aviation, especially in Makassar Air Traffic Service Center.
2. Provide procedure to minimize the risk of similar callsign or callsign confusing.

The strategy to answer the first objective is to inventory a number of similar callsign in aviation, and then categorize, group, and classify. Based on the categories, groups and classes then proceed by analyzing the possible chances of errors that may occur to avoid miscommunication and misunderstanding between speakers and listeners, while the way to answer the second one is to find an initial procedure, as a result of question number one, to minimize the risk of similar callsign or callsign confusing. The results of this analysis will be donated to the agency authorized to regulate and determine callsign in aviation.

D. Significance of the Research

The present study will have a significant contribution to both theoretical and practical context. The theoretical contexts might show how the application of Ground Criterion Theory (GTC) that proposed and developed by Clark and Schaefer (1989).

Based on this theory, it is postulated that the speaker and the listener (agents) involving to reach a state of mutual understanding (or even belief) about what was said and meant. What is the point, in generally speaking this theory is supposed to include any achievement of commonality between agents (in this case, ACT personnel and pilots), including actual beliefs of the communication party, about the

communicated information and joint intention or goals for taking action for their job. And this is main issue to discuss in this research.

For the practical purposes, the result of this study provides a meaningful point for a good understanding the procedure and risky problem might happen in the similar callsign in verbal air ground communication. This thesis will also be good information and for practical way in anticipating similar callsign and its problem in verbal air ground communication.

CHAPTER II
REVIEW OF LITERATURE

A. Previous Studies

1. Some Related Studies of the Research

David McMilan's (1998) has done a research entitled Miscommunications in Air Traffic Control mentioned that miscommunications between pilots and air traffic controllers are an international problem. There are many factor cause verbal miscommunication, including callsign confusing by callsign similarity, Number Problem, environment, Pilots and Air Traffic Controllers psychological condition.

In a research entitled Miscommunication in Pilot – Controller Interaction (Haryani Hamzah, 2018), he defined miscommunication that there are indications of a misunderstanding in conversations or messages cause of a misinterpretation or misunderstanding of a messages miscommunication in air-ground communication can lead an accident or incident of aircraft. The nature of language and the ways it is interpreted by individual could lead to misunderstanding, even when both pilot and air traffic controller speak English fluently.

There are many factors contribute verbal air – ground miscommunication, Procedural deviation often occurred in the routine communication of the control controller vague and even incomprehensible messages. Instead of sticking to aviation standard phraseology, pilots and controllers sometimes switch to simple English during transmission. Another factor leading to miscommunication is unclear instructions (usually from the controller) or unclear requests (usually from the pilot).

The next research was done by Ana – Marija Pliso (2014). This research is about Phraseology in Aviation English. The idea of this research started from Ana –

Marijo Pliso's safety awareness, and she then run a research entitle Non Standard Phraseology in Aviation English. The result of this research found that the usage standard phraseology in verbal air – ground communications very important to reduce miscommunication.

Furthermore, Cushing (1994), in his wonderfully titled "Fatal Words: Communication Clashes and Aircraft Crashes", analyzed a number of examples of miscommunication in aviation. Although his work spurred the aviation industry into even more rigorous standardization of an already extremely highly coded and scripted form of communication, there still have been new examples of aviation accidents and incidents where (mis)communication is known to have been a factor

Much more examples of aviation accidents and incidents where (mis)communication is known to have been a factor, for instance the "Brazil 2006" accident (Oliveira, 2007). Over the past decades a number of researchers have looked at particular aspects of aviation communication, from the work of Charlotte Linde (NASA, USA) on the 'Linguistic Analysis of Aviation Accidents' (Goguen and Linde, 1983; Linde, 1988) to that of Maurice Nevile (Australia) on 'communication in the cockpit' (Nevile and Walker, 2005; Nevile, 2008; Falzon, 2009). Their current research is directed towards investigating the underlying problems associated with radio communication for pilots whose first language is not English.

This is the reason why several provisions on callsign and radio communication in aviation were regularized. For example, ICAO Annex 10 Aeronautical Telecommunications. In ICAO Annex 10 part 5.2.7.3.1, it mentions that for safety reason, the aircraft callsign can be temporarily changed by Air Traffic Controller. Means, ATC will have their own perceptions of changing callsign because there is no standard procedure for changing similar callsign.

Recently, there have been calls for greater research into miscommunications and the means by which current research can be integrated with the problem of similar callsign in verbal air ground communication. The first step is to begin applying what is already known. There is a need to heighten awareness amongst pilots and controllers of the nuances of language. As part of their training, they should be provided with a deeper insight into the structures of language and the way that phrases and words can be misinterpreted. They need to be mindful of how a transmission sounds to its recipient a successful message must be sent, received and correctly interpreted and be aware of, and avoid, common types of linguistic misunderstandings. Use of deliberate miscommunications should form a part of ATC training, and instructors and team leaders need to assiduously police ATC/pilot communications.

What has been studied and revealed by previous researchers is different from what was done in this study. This research focuses on similar callsign in verbal air ground communication by examining two main sides, namely the procedure and risky problem. Why this one is important, because similar callsign or callsign confusion can be a starting point for accidents and incidents.

2. Full Callsigns and Abbreviated Callsigns

In the world of aviation, there are provisions that govern Full Callsigns and Abbreviated Callsigns. This is in line with the initiatives that ATC operators can take if deemed necessary to avoid callsign confusion but does not apply to type (c) below. In relation to the point, it is found here the rules governing the use of aircraft callsigns are clearly regularized ~~laid~~ down in ICAO Annex 10: Aeronautical Communications, Volume II - Communication Procedures, Chapter 5. Relevant paragraphs are summarised below.

It is known that there are three different types of aircraft callsign may be encountered or identified (see table below), as follows: Type (a) The characters corresponding to the registration marking of the aircraft (e.g. ABCDE). The name of the aircraft manufacturer or model may be used as a prefix (e.g. Airbus ABCDE); Type (b) The telephony designator of the aircraft operating agency, followed by the last four characters of the registration marking of the aircraft (e.g. Rushair BCDE); and Type (c) The telephony designator of the aircraft operating agency, followed by the flight identification (e.g. Rushair 1234). In order to show the differences, below is the summarized of the different types, taken from the outstanding sources, shown in the following table;

Table 2 Full Callsigns and Abbreviated Callsigns

Example of Full Calsign and Abbreviated Callsign				
	Type (A)		**Type (B)**	**Type (C)**
Full Callsign	ABCDE	Airbus ABCDE	Rushair BCDE	Rushair 1234
Abbreviate Callsign	ADE or ACDE	Airbus DE or Airbus ABDE	Airbus DE or Airbus BDE	No Abbreviated form

(Source: www.skybrary.aero/index.php/Aircraft_Call-sign)

The difference between Type A and B is that in Type B there is a reduction in the number of bits, from 5 digits to 4, for example or from 4 digits to 3 only, but this does not apply to type (C).

For cases like this, it must be understood that flight identification may be the 'public' flight number used for ticketing and aircraft handling (in the airport) or it may be an alternative unique alphanumeric string and character. Also, the "telephony designator of the aircraft operating agency" will, in airline use, be the designator of the company for whom the flight is being operated, which may not be the operator of the aircraft. It is so, the full callsign must be used when establishing communications.

It is a must (here ATC operator and Pilots). This is still about avoiding miscommunication between ATC operator and Pilot. After satisfactory communication has been established (in theory used in this research it is called Ground Criterion Theory), abbreviated callsigns may be used provided that no confusion is likely to arise; however, an aircraft must use its full callsign until the abbreviated callsign has been used by the ground station, in this case by the ATC operator system. Callsigns may be abbreviated only in the manner shown below (again, refer to the Table 2 above). Types and Description are as follows;

Table 3 Three Different Types of Aircraft Callsigns

No.	Type	Description
1	A	The first character of the registration and at least the last two characters of the full callsign (the name of the aircraft manufacturer or model may be used in place of the first character);
2	B	The telephony designator of the aircraft operating agency, followed by at least the last two characters of the callsign;
3	C	No abbreviated form.

In fact, as the study cases for this research, most airline callsigns belong to type (c) for which there is no abbreviation. Therefore, abbreviations such as “1234” or “Rushair 34” are not permissible or acceptable. It is strongly known that an aircraft is not permitted (allowed) to change its callsign during flight, except temporarily on the instruction of an air traffic control unit (ATC) in the interests of safety. This must be an initiation from the ground communication that is handled by ATC operators

In order to avoid any possible confusion, when issuing ATC clearances and reading back such clearances, controllers and pilots must always add the callsign of the aircraft clearly to which the clearance applies and communicated to.

3. Accidents and Incidents

SkyBrary (https://www.skybrary.aero/index.php/Call-sign_Confusion) shows two things that might happen in air navigation, namely accidents and incidents. These two things are closely related to similar callsign or callsign confusion. The following events include CallSign Confusion presented by SkyBrary as a contributory factor:

1. B738/B738, vicinity Oslo Norway, 2012 (On 31 October 2012, a Boeing 737-800 on go around after delaying the breaking off of a fast and high unstable ILS approach at Oslo lost separation in IMC against another aircraft of the same type and Operator which had just taken off from the same runway as the landing was intended to be made on. The situation was aggravated by both aircraft responding to a de-confliction turn given to the aircraft on go around. Minimum separation was 0.2nm horizontally when 500 feet apart vertically, both climbing. Standard missed approach and departure tracks were the same.)
2. A333 / A319, en-route, east of Lashio Myanmar, 2017 (On 3 May 2017, an Airbus A330 and an Airbus A319 lost prescribed separation whilst tracking in opposite directions on a radar-controlled ATS route in eastern Myanmar close to the Chinese border. The Investigation found that the response of the A330 crew to a call for another aircraft went undetected and they descended to the same level as the A319 with the lost separation only being mitigated by intervention from the neighbouring Chinese ACC which was able to give the A319 an avoiding action turn. At the time of the conflict, the A330 had disappeared from the controlling ACCs radar.)
3. B738/A319 en-route, south east of Zurich Switzerland, 2013 (On 12 April 2013, a Ryanair Boeing 737-800 took a climb clearance intended for another Ryanair

aircraft on the same frequency. The aircraft for which the clearance was intended did not respond and the controller did not notice that the clearance readback had come from a different aircraft. Once the wrong aircraft began to climb, from FL360 to FL380, a TCAS RA to descend occurred due to traffic just transferred to a different frequency and at FL370. That traffic received a TCAS RA to climb. STCA was activated at the ATS Unit controlling both Ryanair aircraft.)

4. B190 / B190, Auckland NZ, 2007 (On 1 August 2007, the crew of a Beech 1900 aircraft holding on an angled taxiway at Auckland International Airport mistakenly accepted the take-off clearance for another Beech 1900 that was waiting on the runway and which had a somewhat similar callsign. The pilots of both aircraft read back the clearance. The aerodrome controller heard, but did not react to, the crossed transmissions. The holding aircraft entered the runway in front of the cleared aircraft, which had commenced its take-off. The pilots of both aircraft took avoiding action and stopped on the runway without any damage or injury.)
5. B737 / B738, vicinity Amsterdam Netherlands, 2018 (On 29 March 2018, a Boeing 737-700 commenced a late go-around from landing at Amsterdam on a runway with an extended centreline which passed over another runway from which a Boeing 737-800 had already been cleared for takeoff. An attempt by the controller responsible for both aircraft to stop the departing aircraft failed because the wrong callsign was used, so low level divergent turns were given to both aircraft and 0.5nm lateral and 300 feet vertical separation was achieved. The Investigation concluded that the ATC procedure involved was potentially hazardous and made a safety recommendation that it should be withdrawn).

This incident occurred in the period 2007-2018. Every incident and accident in flight system would have claimed many lives. A small mistake can pose a big risk.

That is a fact. Although it is believed that air transportation is the safest means of transportation. What are the effects of callsign confusion for air navigation are about loss of communication, loss of separation, level bust, AIRPROX, or midair collision. This is the essence and the main concern of this research.

In AirNav Indonesia in particular, similar callsign is something that always gets special attention. This, it can be proven that AirNav Indonesia always distributes initial reports of similar callsign in one sector at certain dates and hours. This must have a good coordination between sectors. It is important to know in advance for ATC operators who are on duty on this schedule (see appendix 6). Example of the contents of the letter attachment as follows

Table 4. Kind of Similar Callsign – Reminder from LPPNPI 2020

No	Flight Number	ADEP	ADES	ETD	ETA	Route No
1	BTK7127	HLP	BKS	09:20	10:20	AU.012/64/7/DRJU-DAU-2019
	GIA7127	PSK	PLM	08:35	09:25	AU.012/81/19/DRJU-DAU-2019
2	BTK7128	BKS	HLP	10:50	11:50	AU.012/64/7/DRJU-DAU-2019
	GIA7128	PLM	TKG	09:55	11:00	AU.012/81/19/DRJU-DAU-2019
3	TNU524	KOE	ARD	04:25	05:15	AU.012/84/23/DRJU-DAU-2019
	LKN254	DPS	ARD	02:00	04:30	AU.012/45/14/DRJU-DAU-2019
4	QZ697	DPS	SUB	04:15	05:15	AU.012/76/2/DRJU-DAU-2019
	QG697	SUB	CKG	05:05	06:25	AU.012/63/3/DRJU-DAU-2019
5	GA323	SUB	CKG	08:55	12:55	AU.012/87/13/DRJU-DAU-2019
	QZ323	KUL	SUB	08:55	11:45	AU.013/35/15/DRJU-DAU-2019

legend;
ADEP= aedrome of departure, ADES= aedrome of destination, ETD= estimate time departure, ETA= estimate time arrival.

The list of Similar Callsigns – Reminder above are taken from the Letter of AirNav Indonesia sended to Direktur Angkutan Udara Direktorat Jenderal Perhubungan Udara No. lpp.020/0/00/LPPNPI/KMP.04/3/2020 regarding Similar

Callsign (see the instruction in appendix 6). This letter emphasizes the importance of concern the ETD and ETA that will cross into a sector.

B. Theoretical Background

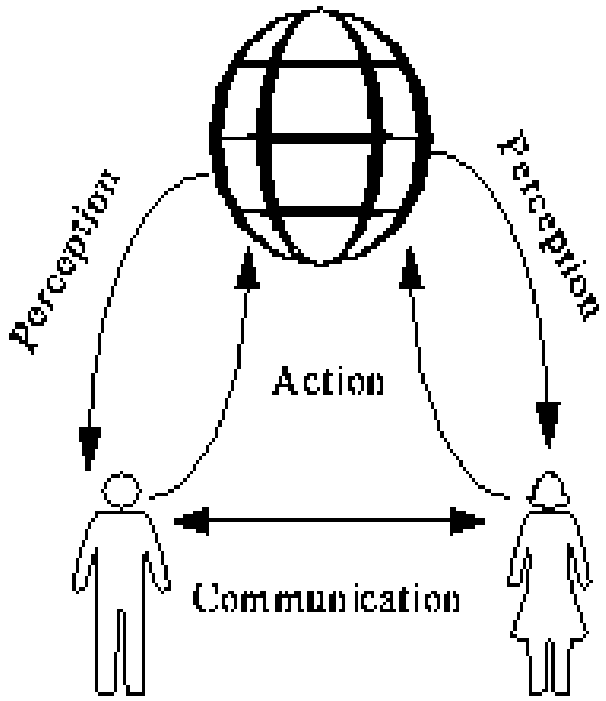
1. Principle of Communication

Miscommunication is one particular case of a lack of alignment of agents' mental state, specifically one in which they diverge on the occurrence or results of communication. The type of miscommunication can now be classified as to the source of the non-alignment about the communicative act - whether the problem was recognizing the action as having occurred, or interpreting the meaning. Clark, (1994) identifies 4 different levels of conversation at which problems for maintaining common ground may arise. In a presentation that belongs to Dillenbourg et. al (1996a), the discussion of these levels and generalize them to apply to grounding in multi-modal collaboration. We take up these points again in the next section, but here we can apply them specifically to aspects of miscommunication. Also, the results of perception or action may also indicate that other related beliefs are not consistent with the beliefs of others or the facts in the world (some sort of misconception), and lead to other action to reconcile this non-alignment. We consider miscommunication as part of a more general framework of lack of alignment of agents mental states, and actions to repair miscommunication as cases of acting to reduce this non-alignment.

In general, however, the communicative situation is more complex than just a comparison between the mental states of two communicating agents - there is also the world in which the agents are embedded and communicating about. It is also possible for agents' mental states to get out of alignment with the world; an objective

misconception by an agent takes place when the agent's beliefs do not reflect the actual state of the world

In addition to communicating with each other, the agents can perceive and act in the world, as illustrated in Figure 2. Thus we must also consider cases in which agents do not perform the action that they intended or in which they perceive the world incorrectly.



(Dillenbourg, et al: 1996b).

Figure 2. Communication with Perception and Action

Additionally, action and perception in the world can be used for implicit communication, conveying information to an observer without an explicit natural language utterance. Thus, in reality, Figure 2 should have all communication between agents channeled through the perception and action in the world, although some actions will have communication as their primary, conventional (illocutionary) purpose, while others may have the communication only as a perlocutionary effect (Dillenbourg, et al: 1996b).

The relation of the world to the mental states of agents plays an important role in both miscommunication and recovery from miscommunication (Clark, 1994). First, errors in action or perception are often the cause of the lack of alignment in mental state which causes the miscommunication. Secondly, the world can be a prime resource for recognizing mistakes and arbitrating between conflicting interpretations. Looking again at Figure 2, we can see that there are at least three different vantage points for considering miscommunication: the *objective* (view of the 'world'), and the views of each of the two agents.

A subjective viewpoint of non-alignment is achieved by embedding (-1) or (0) within the beliefs of A or B. It is this subjective view of non-alignment which will be the (partial) motivation for communication. A very general case of non-alignment is where the object is simply a belief held by one agent and not another. This can be the main motivation for performing acts such as □ in the first place, including both initial presentations, and acknowledgments as well as repairs of miscommunication. The researcher now considers some approaches to the more general problem of reaching alignment (or common ground) in mental state, including, but not limited to repairing miscommunication

2. Grounding Criterion and Collaborative Effort

Grounding is the process of adding to the common ground between agents (Clark and Schaefer, 1989). Taken narrowly, this involves reaching a state of mutual understanding (or belief) about what was said and meant. Taken more generally, it can include any achievement of commonality between agents, including actual beliefs about the communicated information and joint intentions or goals for future action. Clark and Wilkes-Gibbs (1986) point out that it is often not necessary to fully ground every aspect of the interaction, merely that the agents reach the *grounding*

criterion: ``The contributor and the partners mutually believe that the partners have understood what the contributor meant to a criterion sufficient for the current purpose." What this criterion may be depends on the reasons for needing this information in common ground and can vary with the type of information and the collaborators local and overall goals.

Clark and Wilkes-Gibbs (1989) also consider another important principle, that *least collaborative effort*. Contrary to classical efficiency principles, which try to minimize effort on the receiver, or the number of repairs, Clark and Wilkes-Gibbs's principle trues to minimize the *total* effort of the collaborators. This means that in some cases the cost of producing a perfectly interpretable utterance may be more than producing a flawed utterance, which can be easily repaired. These costs include both effort of producing and understanding an utterance, as well as total time for the collaboration.

Clark and Brennan (1991) discuss grounding in different media. They point out that different media bring different resources and constraints on grounding as well as having different associated costs. They describe several media (including, face-to-face, telephone, video-teleconference, terminal teleconference, and email) according to whether they have the following properties: copresence (can see the same things), visibility (can see each other), audibility (can hear each other), contemporality (messages received at the same time as sent), simultaneity (can both parties send messages at the same time or do they have to take turns), sequentiality (can the turns get out of sequence), reviewability (can they review messages, after they have been first received), and reviseability (can the producer edit the message privately before sending). Also, the following costs are considered for these media: formulation costs (how easy is it to decide exactly what to say), production costs

(articulating or typing the message), reception costs (listening to or reading the message, including attention and waiting time), understanding costs (interpreting the message in context), start-up costs (initiating a conversation, including summoning the other partner's attention), delay costs (making the receiver wait during formulation), asynchrony costs (not being able to tell what is being responded too), speaker change costs, fault costs, and repair costs. Since different media have different combinations of these constraints and costs, one would expect the principle of least collaborative effort to predict different styles of grounding for use in different media.

Clark and Schaefer (1989) presented an off-line descriptive account of the grounding process in conversation. This was followed up by Traum (1994) with an on-line computational model of grounding in conversation. In order to achieve a kind of predictive model of grounding behavior in a multi-modal context, and relate the grounding process to repair and broaden communicative action beyond just spoken conversation, we need to focus on why an agent would perform a particular communicative act as part of the grounding process. Towards this end, we are collecting and examining data of how grounding is performed in multi-modal collaborative problem solving.

3. Effective Communication

Communications are effective when the recipient of a thought, whether by listening or reading, understands the meaning intended by the speaker or writer. Good communication is simple and direct, sometimes intensified by emotion, but never confusing. For example, when asking his son to mow the lawn, the father from the previous scenario would have been more successful if he had taken the time to make sure his son was listening, and had chosen his words more carefully:

“Mike,” said the father addressing his son as he walked out the door to work. The father paused, waiting for the teenager to raise his eyes from the cereal he was gulping down. ‘We are going out of town this weekend, so you need to mow the lawn today. Any problem with that?’. ‘No, sir. I was going to the mall with Ted and Jim, but I can get it done before I leave’.

“Great. I appreciate it. See you tonight,” said the father, heading out the door. The lawn was mowed and edged, and the family had a non-eventful evening. The speaker and listener agreed on the message “mow the lawn today.” The father did not add a false choice, and the son repeated his understanding of the message, confirming the communication. Whether a policeman talking to a criminal, a parent talking to a child, a manager to his or her staff, or a preacher to his or her flock, plain language combined with other communication skills increases understanding and rapport between parties.

4. Causes of Communication

According to scientists, humans began speaking about 100,000 years ago, and writing began around 4000 B.C. Prior to written language, humans used pictures (cave drawings), which evolved to word symbols. The evolution of language, what some have called the “human system of communication,” proves false the old adage “a picture is worth a thousand words,” since it’s almost impossible to convey conditional, complex, or complicated ideas with a simple image (Gibbens, 2018).

While some linguists suggest that an accurate accounting of the number of words in the English language is impossible. Due to the sheer number of words available to choose from, the opportunity for muddled communication is high, even when two people have similarly sized vocabularies. The specific words known to each person, as well as the understood meaning of each word, can vary significantly

due to different environments, cultures, and experiences. The following is the concept of causes of miscommunication that adapted from Michael Lewis's concept (https://www.moneycrashers.com).

a) Misaligned Vocabularies

"Plain language" refers to the preference for words that are in everyone's vocabulary – what linguists term the "core vocabulary" – consisting of about 200 to 300 words. These words are mostly verbs, pronouns, and demonstratives, such as "his" and "that," which help distinguish the subject the speaker or writer is referring to. These words are used frequently and across many contexts to express meaning and intent, usually without misunderstanding.

This is common, as the initiator of communication, the speaker or writer must choose words that are easily understood by the listener or reader. For example, a 10-year-old is unlikely to understand the meaning of "plethora," so "plenty" or "a lot" would be better choices. A communicator should always consider his or her audience when communicating.

b) Messy Thinking

Messy thinking is closely related to stress situation and unmood feeling. General speaking, Messy thinking might result in messy speaking, which usually occurs when someone begins speaking before completing his or her thought process. As a consequence, listeners are taken on long, convoluted journeys filled with contradictions, extraneous information, instruction, and premature conclusions.

Messy thinking usually happens during periods of stress or high emotion. Let us remain what Plato's observation; the wise men speak because they have something to say, while fools speak because they have to say something. In other

words, think about the intent of your message before speaking, and when speaking, choose language that is precise, clear, and easily understood.

c) Faulty Definitions

One of the problems in communication is words sound alike that is homophone. Homophones are words that sound alike or nearly alike, but they have different definitions. Let us see the example for word, *discreet* means careful and circumspect, while “discrete” means distinct or separate. Since the communication for flight controlling in English so some homophones that sound alike or nearly alike are presented in the following examples:

Table 5. Homophones that Sound Alike or Nearly Alike

No	words	Words sound alike
1	Abhorrent	aberrant
2	Alternate	alternative
3	Loose	lost
4	disassemble	dissemble
5	Discrete	discreet
6	Weather	whether
7	Real	reel
8	disassemble	dissemble
9	Emigrate	immigrate
10	Sax	sacks
11	Flounder	founder
12	horde	hoard
13	all ready	already
14	Plain	plane
15	Vain	vane

The choice of words is an important key of avoiding miscommunication. It is because the wrong word (linguistically pronouncing) can confuse the listener or reader (here, the communication between ATC operator and Pilots). If it is in doubt, consult a dictionary (at the moment it is easy to check a word in an online dictionary) or simply don’t use the word at all.

d) False Civility

False civility is a desirable trait in all societies, it's often misunderstood and misinterpreted. Civility is a matter of context – what might be considered rude or thoughtless in one situation could be proper in another. A parent warning a child to get out of the street shouldn't value the child's feelings over his or her safety; a supervisor disciplining a subordinate for poor results shouldn't dilute or confuse the message in the hopes of being perceived as "nice." Civility means being conscious and considerate of how actions and words affect others, but it does not mean beating around the bush or faking emotions.

e) Sloppy Language Habits

Unconscious patterns of thinking, speaking, and interacting are developed over time. These habits affect your daily activities and your relationship with your environment. They surface in speaking and writing, and they often lead to miscommunication. Be careful when you are in situation and you use the following:

Acronyms.

Acronyms are abbreviated versions of phrases or organization names that are formed by combining alphabetical characters to create a new word, such as OSHA – shorthand for the Occupational Safety and Health Administration of the Federal Government. Acronyms save time and may improve recall of the underlying meaning. Unfortunately, acronyms are so ubiquitous in speech and print that their meanings are often misinterpreted. For example, the meaning of the acronym "ACA" could be correctly interpreted as "Affordable Care Act," "American Correctional Association," "American Camp Association," or "American Chiropractic Association." If you use an acronym, be sure to provide its meaning so your audience is not confused,

Jargon and Colloquialisms.

Many social, business, or professional groups develop special vocabularies to describe concepts and activities specific to their group ("jargon"). Examples include "baluster" in architecture, "arabesque" in ballet, and "all in" in poker. Colloquialisms are phrases and words from specific geographic regions typically used in conversation, but not formal writing. The meaning of 'pot liquor', a term used to describe the juices left in a pot after cooking peas or collard greens, would be readily understood in the South, but less so above the Mason-Dixon line. Jargon and colloquialisms can add color to speech and writing, even enhancing understanding where their meanings are understood, but the possibility of misunderstanding remains high,

Assumptions, Stereotypes, and Allusions.

It's well known that the use of assumptions – taking something for granted or without proof – can make you look bad. Stereotypes (inaccurate simplistic generalizations) and allusions (indirect, often incorrect references) can have the same result: muddying your intended message and confusing listeners or readers. There is little to gain from their use and much to lose, so avoid them whenever possible, and

Buzzwords.

Words that sound impressive but convey no special meaning are in a special class by themselves. They have no place in intelligent speech or writing. The use of buzzwords is so flagrant that drinking games are built on their use in political speeches. However, politicians are not the only guilty parties – some corporate cultures are infamous for their use. Scott Adams, the creator of the Dilbert Principle (Adam, 1995), even suggests that employees learn to use big, vague words as they

progress up through management, preferring a sentence such as “I utilized my multi-tined tool to process a starch resource” to “I used my fork to eat a potato.”

5. Government-Speak and Legalese

Legal and regulatory documents are especially open to confusion due to both their use of technical terms and a culture that often rewards quantity of words over quality and intent. As you might expect, the need for improved written communication extends beyond the American borders and even the English language. There are organizations around the world that are dedicated to improving government document understanding through the use of plain language: Plain Language Association International in Canada, COSLA in France, and CHIARO! in Italy.

C. Conceptual Framework

In order to make sure the procedures of this research, the Conceptual Framework is formulated as follows

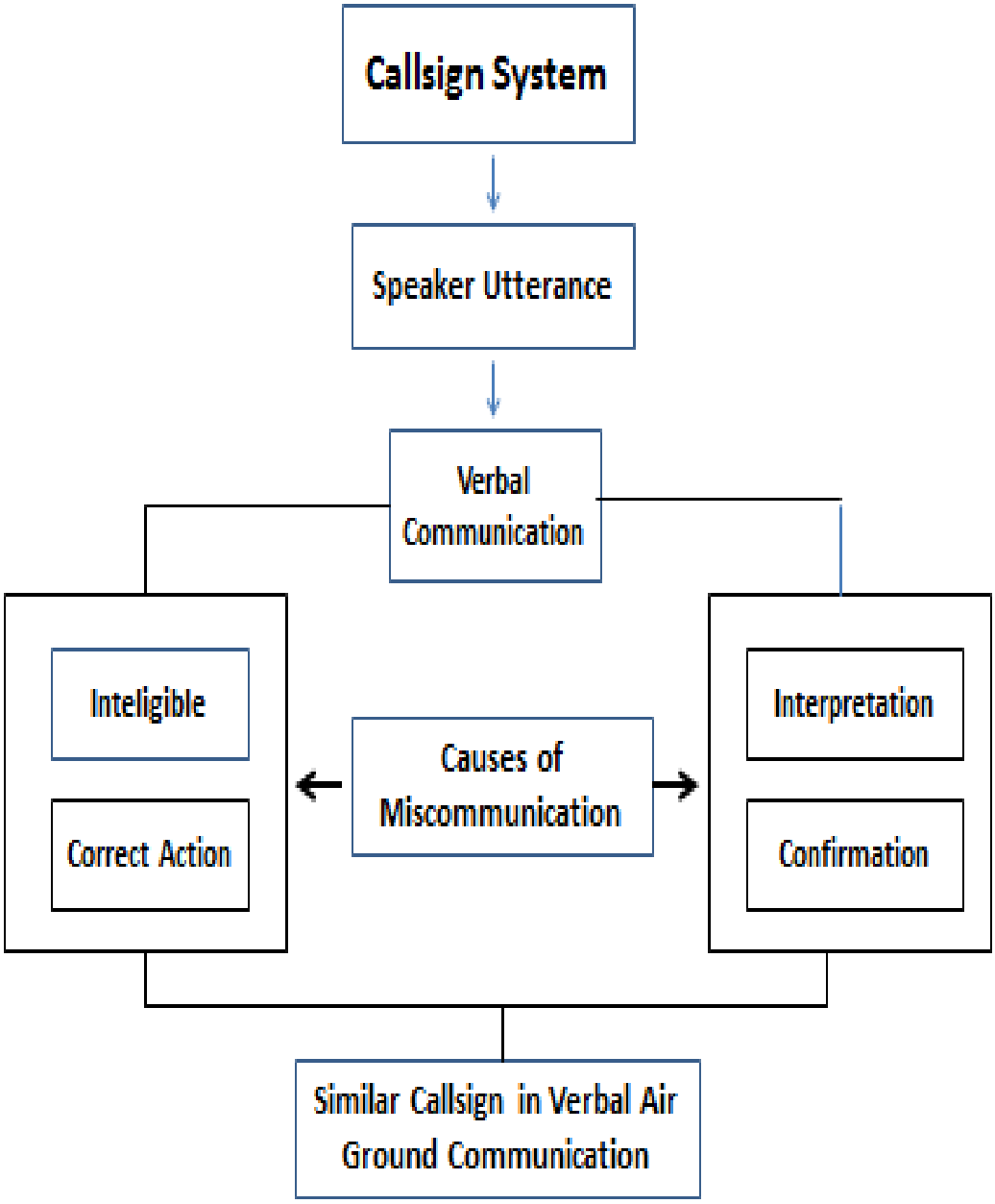


Figure 3. Conceptual Framework