



Enhancing Aviation Safety: Addressing Miscommunication Between Pilots and Air Traffic Controllers

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ABSTRACT

- **Miscommunication in aviation:** Refers to misinterpretation of instructions, absence of readback, or incomplete communication between pilots and controllers
- **Importance of clear communication:** Vital for safe and efficient aircraft operations, preventing potential disasters
- **Impact of miscommunication:** Between 1999-2019, contributed to 37,908 aviation accidents, highlighting the need for improved communication protocols
- **Categorization of miscommunications:** Groups include no communication, language barriers, phraseology problems, and misunderstandings due to accents or vocabulary differences
- **Recommendations for enhanced safety:**
 - Improved training and proficiency assessments for pilots and controllers
 - Standardized phraseology to ensure clarity in communication
 - Advanced frequency management technology for efficient communication
 - Language proficiency requirements for international flights to address language barriers
- **Benefits of the poster:** Provides practical suggestions to mitigate miscommunication risks, benefiting aviation authorities, airlines, controllers, and pilots
- **Ultimate goal:** Ensure passenger safety and operational efficiency in aviation industry

Introduction

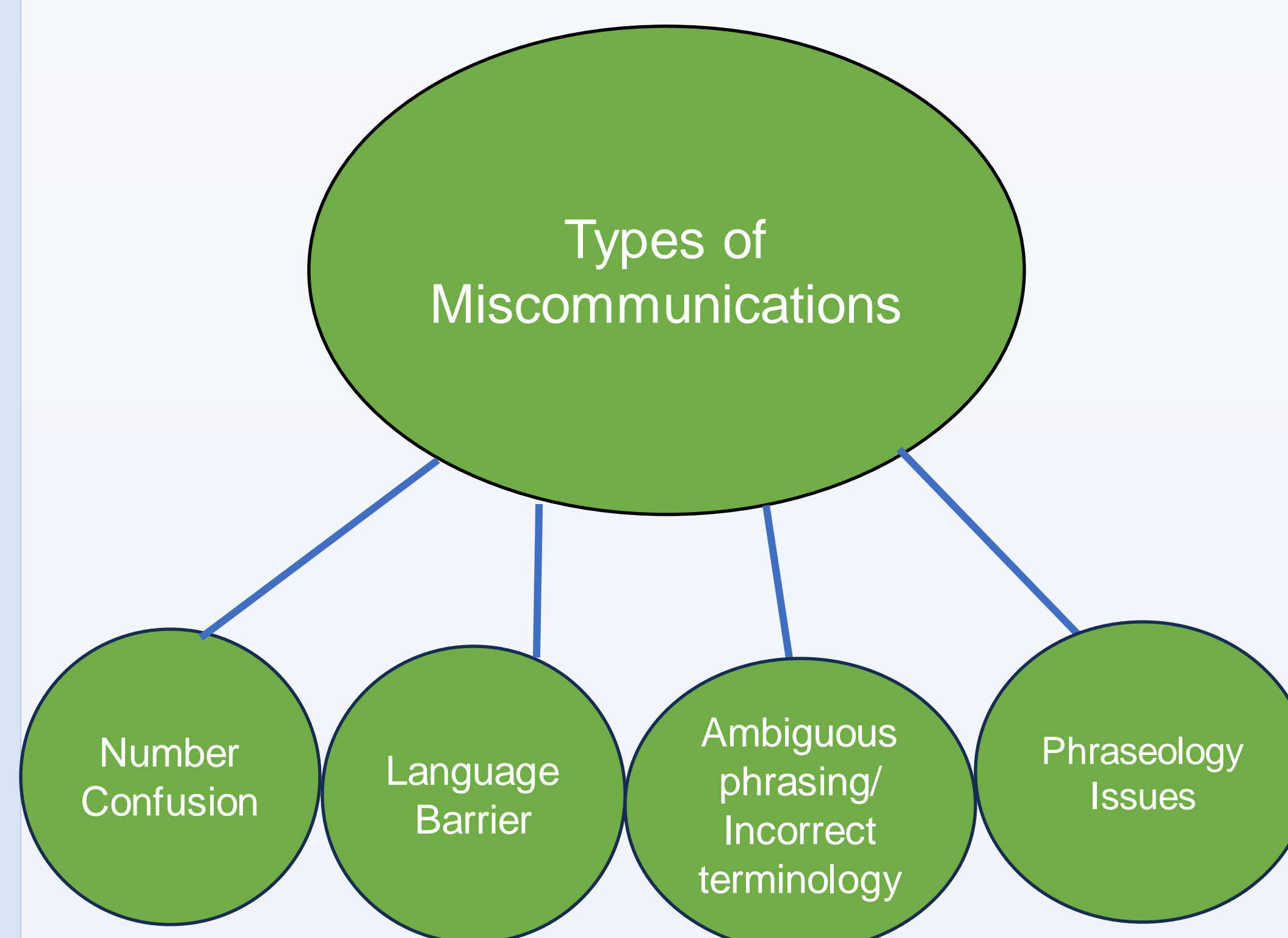
Flying is one of the safest ways to travel, with a very low fatality rate. However, clear communication is key to maintaining this safety record. Miscommunication, particularly due to language barriers between pilots and air traffic control, can lead to accidents. This paper emphasizes the critical nature of understandable dialogue in the skies and explores solutions to reduce risks. By analyzing past miscommunication-related accidents and proposing recommendations, the goal is to enhance aviation safety for all.



What is miscommunication and its importance to pilots and ATC?

In aviation, where the margin for error is slim, precise communication between pilots and air traffic controllers is critical for safety. Misunderstandings can lead to tragic accidents, as history has shown. English proficiency, standard phraseology, and clear radio transmissions are mandated to minimize risks. Despite technological advances, effective human interaction remains at the heart of safe skies. This emphasizes the need for continuous training and innovation to improve communication in aviation.

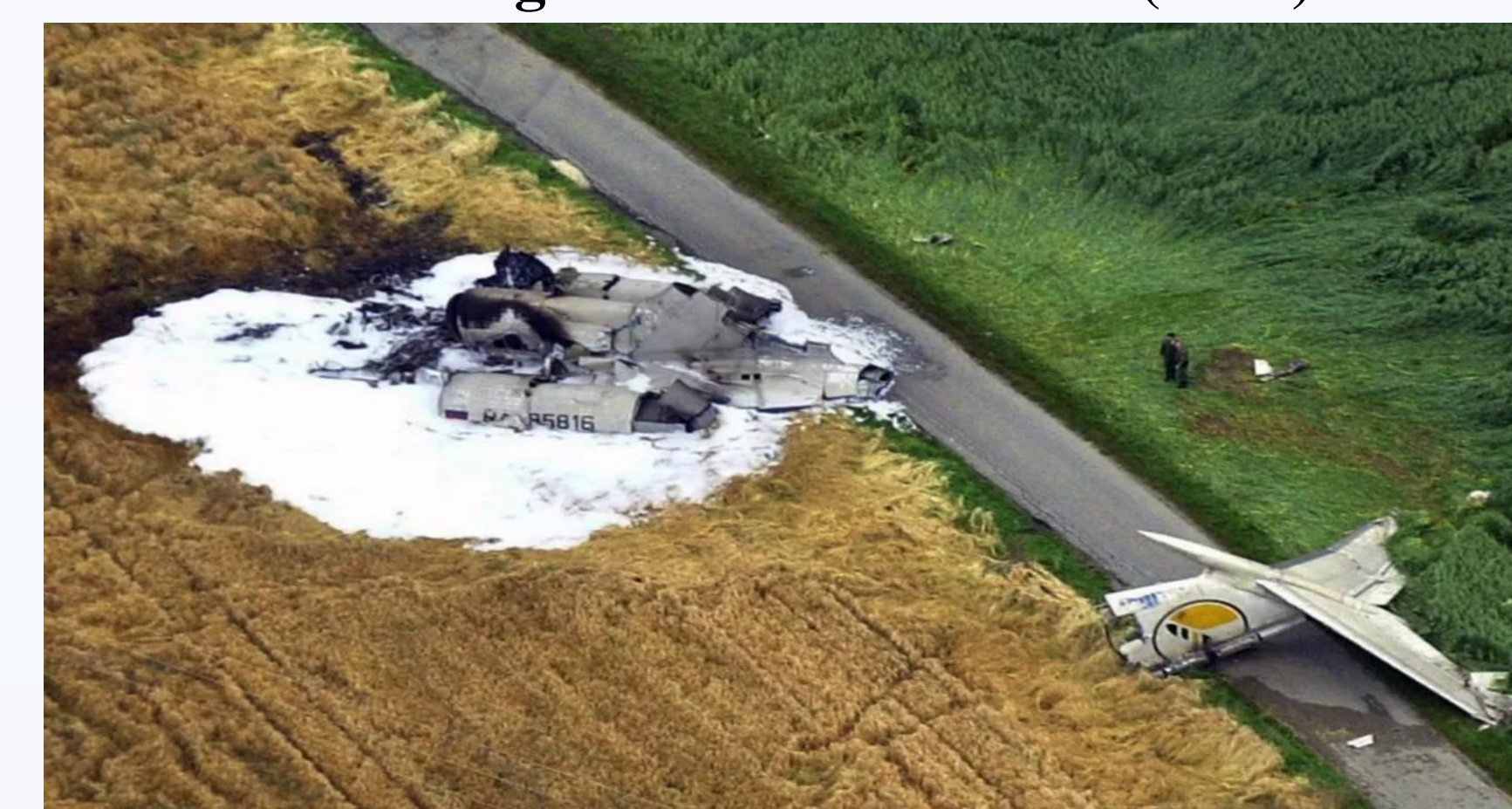
Types of Miscommunications



- **Number Confusion**
 - **Criticality of Accurate Numbers:** Precise numerical information is crucial for safe flight operations. Errors in numbers can lead to incorrect headings, altitudes, or speeds, potentially resulting in mid-air collisions, runway incursions, or other dangerous situations.
- **Language Barrier**
 - **Importance of Clear Communication:** Clear and precise communication is crucial in aviation to ensure safe takeoffs, landings, and overall flight operations. Misunderstandings due to language barriers can lead to serious accidents.
- **Ambiguous Phrasing/Incorrect Terminology**
 - **Importance of Clear Communication:** Clear and unambiguous communication is crucial in aviation to prevent misunderstandings, errors, and accidents. Ambiguous phrasing or incorrect terminology can lead to misinterpretations of critical instructions, affecting flight safety.
- **Phraseology Issues**
 - **Importance of Standardized Phraseology:** Standardized phraseology serves as a universal language in aviation, ensuring a common understanding among pilots and controllers, regardless of their cultural or linguistic backgrounds. It reduces the risk of miscommunication and enhances safety.

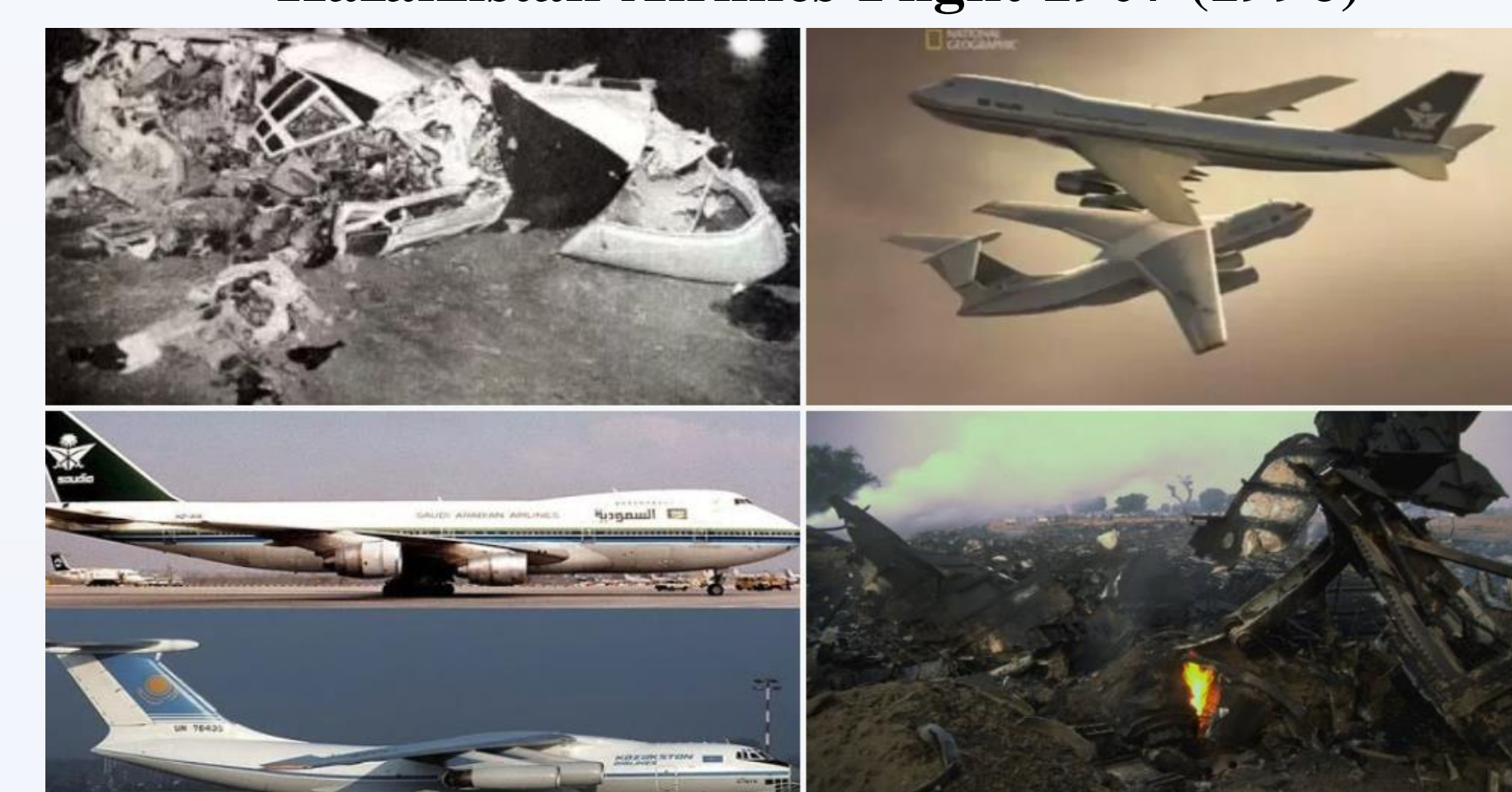
Examples of Incidents

Überlingen Mid-Air Collision (2002)



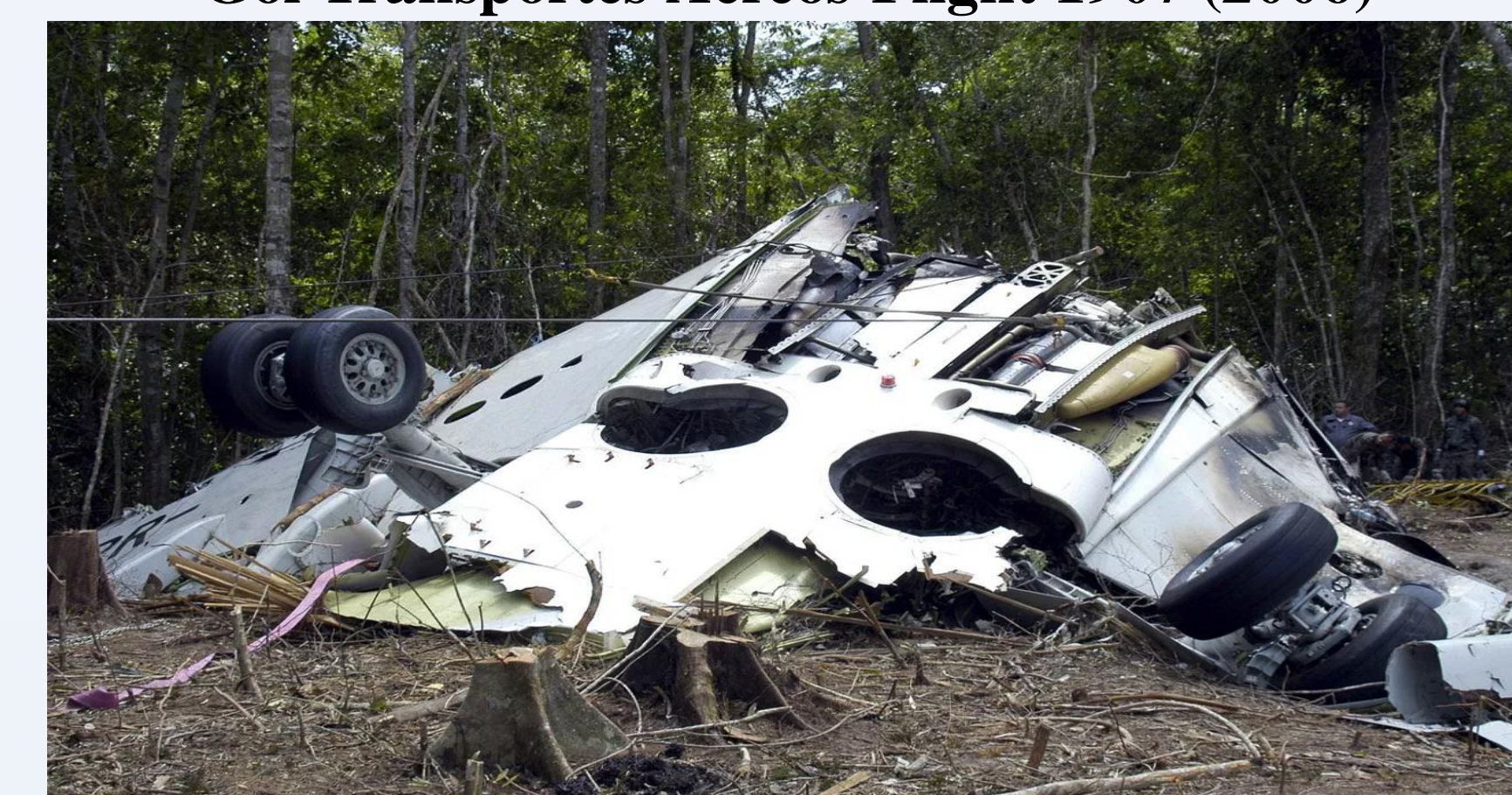
- Russian Tupolev and the DHL Boeing 757 receiving conflicting instructions, can be attributed as a **phraseology issue** with ATC directing both planes to descend while the onboard TCAS systems issued opposite commands.

Kazakhstan Airlines Flight 1907 (1996)



- The Kazakhstani pilots, with limited English skills (**language barrier**), misunderstood air traffic control instructions, leading to the deadliest mid-air collision in aviation history.

Gol Transportes Aéreos Flight 1907 (2006)



- **Number confusion** with the air traffic control led to a loss of radio contact as the pilots cycled through incorrect frequencies, missing critical communication. This breakdown, combined with the Legacy's TCAS being turned off, resulted in the crew not receiving a collision avoidance advisory, leading to the mid-air collision with Gol flight 1907.

Literature Review

- Skaltsas et al. (2013) found that out of 382 messages, 74% of the miscommunications were caused by pilot mishearing, pilot not responding, controller mishearing, and controller not responding.
- Many of the tests and assessments used by ICAO do not meet the international professional standards for language tests. (Charles, 2009)

Recommendations

- **Strong Language skills**
 - The main factor in a good communication is ultimately the strong language skills, using the right phraseology along with the successful read-back/hear-back process is a must in aviation. Both pilots and controllers are equally involved in the air traffic management
- **Pilots must not be afraid to ask**
 - Whether it is about deviations, clearance or any problem that they are facing. Pilots must wisely formulate their statements in a brief, and clear way mentally before addressing it to ATC without missing any core information that ATC needs to know
- **Pilots should be brief**
 - During check-in and while addressing their statement, pilots should use a concise yet clear phraseology. Also, they should be quite alert of the frequency especially on the VFR so they can always be ready to choose an alternative plan.
- **Pilots must provide controllers with clear and thorough pilot reports**
 - For the controllers to share information with other pilots so they can get accurate details about the weather conditions.
- **Effective training for both pilots and controllers**
 - This can be a very important factor along with good practice in order to acquire enough knowledge, so they can learn how to understand each other clearly. Also, this can be achieved by implementing a mechanism for language proficiency assessment for both controllers and pilots so they can ensure that all parties are at the right level recommended by the ICAO.
- **Language proficiency test**
 - This test verifies the effectiveness of the English language communication in aviation context for controllers and pilots. It also checks the fluency, pronunciation, vocabulary, communication, responsiveness and grammar skills according to the terms of ICAO, to proceed contestants must score 6/10 and above.
- **Standard Phraseology**
 - Using a standard phraseology leads to successful communication, when communicating with ATC, pilots exchange safety-critical information and this cannot be understood by the controller unless both parties have a rigid background of a mutual mode of expression that both can understand.
- **AIM**
 - Learning this phraseology and good ATC communication skills must be from a strong source, the Aeronautical Information Manual (AIM) is considered as the best reference because communicating with ATC is an art especially when using the right words. AIM is considered as the most detailed source of FAA-recommended procedures.

Conclusion

Most of the research done emphasizes the idea that miscommunication is one of the most prevalent factors leading to errors when exchanging messages between ATC and pilots. A lot of efforts must be done in order to mitigate the risks that might occur and get a safer traveling experience. All the small details when it comes to pilots-ATC communication must be taken into consideration. A standard phraseology has been considered as the most effective way to reduce possible miscommunication errors. Although some aspects might seem a bit hard to avoid such as the accent barrier, since clarity and pronunciation play a major role in transmitting the intended message, constant training and effective practice can be a great way to help in such issues. Moreover, pilots must be smart when communicating, especially with how and when to use the right terminology; the most important factor is to be brief and get straight to the point. Language tests can help in determining the level of proficiency, however according to several research these tests did not meet the international professional standards and their policy's implementation were not sufficient. Improving the use of the correct phraseology and concentration are important factors to consider in addition to crew resource management and their role in efficient communication between ATC and pilots. The implementation of several systems designed to reduce communication errors can be very helpful in order to increase flight safety which will eventually boost confidence in air transport such as better voice recognition software and more intuitive communication tools. A speech recognition integration can be a helpful way in reducing communication errors too, especially because of its proven efficacy in reducing the costs of ATC services without the need of further sector divisions.

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