The Challenges of Investigating Language in Aviation Accidents:

How Applied Linguistics Can Reveal Subtle Communication Errors

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For Air Safety Investigators (ASIs), the 1977 tragedy of the collision of KLM Flight 4805 and Pan Am Flight 1736 at Tenerife is well known. The accident revealed the catastrophic consequences of miscommunication between pilots and air traffic controllers. In 1996, a mid-air collision of Saudi Arabian Airlines Flight 763 and Kazakhstan Airlines Flight 1907 led the International Civil Aviation Organization (ICAO) Assembly to discuss Language Proficiency Requirements (LPRs) after the Lahoti Commission indicated that a lack of English language proficiency of the Kazakhstan flight crew was a contributing factor in the accident (Centre of Disaster Management). ICAO Resolution A32-16: *Proficiency in the English Language for Radiotelephony Communications* was adopted by the ICAO Assembly in 1998. A significant aspect of these two accidents is that the flight crews of both aircraft as well as the air traffic controller were English as a Second Language (EL2) speakers. Past literature in aviation communications was focused on miscommunications of native speakers, but the focus has shifted to EL2 speakers as the number of multi-cultural flight decks is increasing in the aviation industry. Therefore, it is increasingly important to adequately identify language factors in accident and incident reports. Investigating language in aircraft accidents has posed a significant challenge for ASIs because of its complexity and the lack of a common investigative approach for recording and analyzing language factors. The future of aircraft accident investigation will need to incorporate applied linguistic Subject Matter Experts (SMEs) into investigations where language has potentially played a role.

Applied Linguistics in Aviation

Language can be understood as a system for conveying thought within a group of individuals. Linguistics, the study of language, seeks to "explain and describe how this system works, what are its components, what are relations between such components", etc. (Borowska, pg. 52). Furthermore, applied linguistics extends the field of linguistics by concerning itself with the "theoretical and empirical investigations in which language and communication are central issues" meaning it explores problematic language usage in real-world problems.

Applied linguists began researching Aviation English (AE) after a series of fatal aviation accidents in the 1980s. AE is the de-facto lingua franca (working language) used to communicate in aviation around the world. AE is a narrowly-defined version of English which is generally divided into two categories – 'standard phraseology' and 'plain language'. Standard phraseology is a "prescribed, highly constrained set of phrases to be used . . . in all radiotelephonic communications between controllers and pilots" and includes "special pronunciation and syntax, as well as discourse and dialogue structures" (Estival, Farris, Molesworth, pg. 17). Phraseology was designed to efficiently deliver communication in short, disjointed phrases without losing clarity. Language proficiency requirements are not only a concern for commercial aviation, but for general aviation and other sectors as well. Plain language describes the use of English for communications that are beyond the scope of standard phraseology, such as in emergency or other unusual situations.

Challenges of Implementing ICAO LPRs

Miscommunication has been an issue for a long time, but it wasn't until the 32nd session of the ICAO Assembly that language proficiency issues were acknowledged by the international community. Resolution A32-16 led to the development of the first edition of the ICAO Doc 9835

– *Manual on the Implementation of ICAO Language Proficiency Requirements* in 2004, which sought to assist member states' efforts to comply with the new LPRs (Popa, 2019). However, the issue that persists today lies in the implementation of the LPRs. As indicated by Popa, "users of the Manual on the Implementation of ICAO Language Proficiency Requirements have indicated that more detailed guidance on language testing is needed to effectively implement the language proficiency requirements" (2019). Civil Aviation Authorities (CAAs) are not familiar with English language training and testing, and these industries are largely unregulated. Moreover, there is a lack of standardization of these industries if ICAO member states have different levels of implementations. The only obligation that CAAs have in order to comply with ICAO standards is to certify that personnel have at least an operational language proficiency level 4. In the Brazilian Aeronautical Accident Investigation and Prevention Center's final report on the 2006 midair collision between Gol Transportes Aéreos Flight 1907 and an Embraer Legacy 600 business jet, Brazilian ASIs documented that many of the air traffic personnel received English training at different providers. More importantly, a majority of the air traffic controllers and supervisors received non-satisfactory English evaluations. Elizabeth Mathews, a core contributor to the ICAO English LPRs, states that "The information regarding controller English language proficiency [in the report] is unclear and non-standardized" (2012). This is due to the absence of a global, comprehensive system in place to ensure that all English testing and training providers operate under similar definitions for English language proficiency. ASIs do not have the resources or the knowledge to evaluate language training and testing, so citing potential weaknesses of an English-training or English-testing provider is beyond the scope of a typical investigation. An applied linguistic SME can assist in these evaluations, and recommendations addressing these weaknesses can be produced.

ICAO has issued Standards and Recommended Practices (SARPs) on verbal communication in ICAO Annexes related to pilot and air traffic controller licenses, yet many other aspects of language remain unaddressed in ICAO policy (Mathews, Pacheco & Albritton, 2019). As we can see in Table 1, ICAO has only issued SARPs pertaining to pilot-controller communications; however, ab-initio training, quick reference handbooks, training manuals, etc. are usually presented in English but there are no English testing requirements for reading or for flight training. Not only is this problematic for aviation safety, but ASIs cannot determine if deficiency in English reading skills played a significant role. For example, the investigation report for the Merpati Nusantara Airlines Flight 8968 accident cited that the "Flight Crew Operation Manual and Aircraft Maintenance Manual used non-standard English Aviation Language" within their findings (National Transportation Safety Committee). There is no evidence to support that this had any significance, but it's an issue that can't be overlooked.

Cockpit Voice Recorder Transcripts

Typically, Cockpit Voice Recorder (CVR) audio recordings are not released publicly, so a transcript is produced for documenting the last 30 minutes of communication. Consequently, transcripts are accompanied by a loss of information because there are several linguistic elements left out of the final written account. Farris cites that accident investigation CVR transcripts have limitations in research as ". . . transcripts are not created by researchers for the specific purpose of studies in controller-pilot communications, and are therefore perhaps not sufficiently accurate and detailed for a full analysis of language-related miscommunication events" (Estival, Farris & Molesworth, pg. 126). Evidence such as speech rate, intonation, speech intelligibility, phrasing, and degree of accentedness are not recorded in the report. Mathews reported that the cockpit voice recording of the Embraer flight over Brazil "revealed brief but compelling evidence of

probable English language insufficiency" during an exchange between the Sector 5 controller and the Legacy pilots that wasn't noted in the CVR transcript (2012). The message provided by the controller was standard phraseology, but included long drawn-out pauses and hesitations, which was further complicated by "an accent not easily understood by the Legacy pilots" (Mathews, 2012). An applied linguistic SME can record this communication difficulty by using special symbols to denote pauses and various other elements. The communication difficulty was made apparent when one of the Legacy pilots exclaimed "I've no idea what the hell he said." (as qtd. in Mathews, 2012). CVR transcripts can be rich sources of evidence if an applied linguistic SME provides support in the transcription; otherwise, evidence of language as a contributing factor may be lost.

Conclusion

Miscommunication has and will continue to play a role in aviation accidents and incidents. Great strides have been made in the international civil aviation community to address concerns of how to successfully implement the ICAO LPRs. Organizations like the International Civil Aviation English Association (ICAEA) hold conferences and workshops emphasizing best practices for training and testing of Aviation English. Additionally, more literature concentrated on an applied linguistics approach to analyzing Aviation English has been increasing in recent years. ASIs are still left with a monumental task of relating language proficiency to the series of latent failures leading to an accident. If ASIs employ applied linguistics in the investigation of language factors, then useful data and analysis can be provided for further research into the effect of language in miscommunication.

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Table 1

English Use in Aviation, Where English Impacts Safety

Language Skill Required:	Speaking / Listening	Reading	Writing
Personnel	Only those communication requirements in BLUE are governed by ICAO Standards		
Pilots: Professional	• Pilot-controller • Pilot-pilot, CRM and flight deck communications • Pilot-PAX • Pilot-ground crew • Pilot - Sim instructor	• Aircraft and Operating Manuals • Quick Reference Handbooks • Safety updates and briefings • CBT training devices • Safety materials. • Training materials • Datalink • Flight Management Systems.	• Datalink • Maintenance reports
Pilots: ab initio	• Cadet - ground instructor • Cadet - flight instructor • Cadet - controller	• Training materials • Aircraft Manuals • Safety updates and briefings • CBT training devices • Safety materials.	• Tests
Maintenance Technicians: Professional	• With pilots • Other ground crew • Aircraft manufacturer representatives • Maintenance controllers	• Aircraft manuals • Safety updates and briefings • Training materials • CBT training devices • Safety materials • Training materials	• Records and reports
Maintenance Technicians: ab initio	• Instructors	• Training materials	• Tests
Controllers: Professional	• Controller-pilot • Ground staff • Emergency services	• Training materials • Safety updates and briefings • CBT training devices • Safety materials	• Reports • Datalink
Controllers: ab initio	• Cadet - instructors	• Training materials	• Tests
Cabin crew: Professional	• Passengers • Pilots	• Manuals and learning materials. • Equipment instructions. • Safety updates.	• Reports
Cabin: ab initio	• Instructors	• Training materials	• Tests

Note. Unpublished research from Elizabeth Mathews (2019).