

Spring 4-26-2021

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Aviation English in a Bilingual Context: Bilingual Spanish-English Pilots

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HONORS PROJECT

Submitted to the Honors College  
at Bowling Green State University in partial fulfillment of the  
requirements for graduation with

UNIVERSITY HONORS 2021

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### **Abstract**

The purpose of this study is to investigate the use of English and Spanish in the applied context of aviation by researching pilot experiences in the cockpit within the register of aviation English.

This study investigates pilot's in-flight experiences in relation to language proficiency in the hopes of improving future standards of communication. Expounding on previous research with a focus on native Spanish speaking pilots, this research utilizes a Likert scale survey and demographic assessment to evaluate proficiencies inside the cockpit of bilingual Spanish-English participants. By determining each pilot's use of English outside of the workplace as well as how they acquired English as a second language, the investigation draws conclusions between language acquisition and self-efficacy regarding required duties inside the cockpit. This research also addresses the frequency with which pilots hear their native language over the radio and how language factors relate to each pilot's proficiency and resulting safety within the aviation environment. Results from this investigation indicate the critical relationship between overall language proficiency and proficiency with aviation related tasks within an applied flight context.

**Keywords:** *Aviation English, language proficiency, register, aviation safety, bilingual pilots, Spanish*

## Introduction

Since the very beginnings of aviation, the desire to fly has elicited a worldwide quest for progress and incentive to improve the efficiency of aviation technologies. The advent of the global aviation industry combined with the rapid process of globalization in general has required increased regulations that aim to create the safest flight environment possible. In the field of aviation specifically, the decision to make English the official language in 1951 at the Chicago Conference recognized the central importance of successful communication in mitigating risk factors (Hyejeong 2016). While there are obvious benefits to having a common language used by pilots across the globe, there are impracticalities to ensuring compliance with this rule and determining training methods in addition to testing procedures to ensure compliance.

English has been the de facto language of aviation since 1951; however, major aircraft accidents attributed to miscommunications necessitated the establishment of additional regulating standards. Aviation English is its own register, which is defined as the linguistic features or language associated with specific situations, and in the case of aviation, within a professional context (Halliday 1978). To attempt to provide a minimum level of comprehension, the International Civil Aviation Organization (ICAO) established a standard of proficiencies in 2003 that govern a pilot's and crew's ability to read, write, and speak the English language, before being considered qualified to operate an aircraft internationally. With these proficiencies established, ICAO set a deadline of March 2008 for all pilots and ATC that serve international routes to be tested and meet proficiency standards (SKYbrary 2021). Pilots and ATC are ranked within six standard categories of proficiency; they may or may not be required to retest, based on the level they achieve as determined by their initial test. All pilots and ATC who service international routes are required to test at a level 4 proficiency or higher. This level of

proficiency establishes that pilot's pronunciation only sometimes interferes with levels of understanding, has well controlled grammar with errors only occurring in unexpected situations, and includes the vocabulary necessary to communicate effectively in the register required. Although understanding may be slower when situations occur outside of the standard phraseology, the pilot is expected to be proficient with the language in a way that has been determined to not interfere with flight safety (See Appendix A). Native English speakers, unless determined to have a debilitating speech impediment that limits comprehension are exempt from testing. The standards utilized to determine who qualifies as a native speaker and what level of proficiency a pilot is considered to have are categorized under several descriptors. One of these descriptors is "pronunciation," where they say, for example, that adequate pronunciation "almost never interferes with ease of understanding" which is then applicable between pilots or in interactions between pilots and ATC. Other categories reference the ability to use "complex grammatical structures" and "idiomatic and nuanced vocabulary", as well as being able to "vary speech flow for stylistic effect," in addition to "comprehension of linguistic and cultural subtleties", and being "sensitive to verbal and non-verbal cues" (Hyejeong 2018). These standards have faced challenges relating to their practical implementation, since even after they were developed, countries were then left on their own to determine how to best utilize the standards and train their pilots to meet them; though training recommendations are continuously being developed, much of this work is still in the preliminary stages (Friginal, et. al. 2020). The effectiveness of the standards themselves as well as testing methods have been questioned, as experts attempt to develop the most efficient and safest program to ensure international air travel does not experience accidents in relation to lack of language proficiency (Hyejeong 2016).

A significant number of aviation accidents, resulting in more than 1,000 fatalities have been determined to be caused by a lack of English proficiency and/or miscommunications within the field. (Friginal, et. al. 2020). According to *English in Global Aviation*, the accidents causing these fatalities, “...have been attributed, in part, to inadequate English language proficiency or limitations in intercultural awareness of pilots and air traffic controllers (ATCs)...” (Friginal, et. al. 2020, ix). While some of these incidents have resulted from communication breakdowns between individuals who speak the same language, more often, they are the result of two crew members or a crew member and an air traffic controller that speak different native languages (ICAO 2010).

In this paper I will provide an overview of the previous research on the role of language in aviation safety. I will then briefly explain the present study and my own methodology. Next, I will detail the research questions that were investigated and the participant pool before sharing my results. I close with an analysis of those results and some suggestions, both for future research and for the field of aviation as a whole. Though investigation into aviation English and related accidents is a relatively new field with its development beginning in the early 2000s, its significance in aviation safety is quickly being realized across the industry, and a growing amount of research on the topic has resulted. My research expounds upon existing investigations and reports by shifting the focus to what can be done to prevent future accidents. As this is a recent field of study, past exploration on this topic has been reactive and has focused on analyzing accidents that have already occurred. My research attempts to aid in the shift to a proactive safety culture in which recommendations are made in the hopes of preventing future accidents.

### Literature Review

The International Civil Aviation Organization (ICAO) mandates collaboration between its 192 member states in an effort to encourage safety and efficiency within the worldwide aviation environment. Member states receive representation and are provided resources to support their safety as part of a large collaborative effort. The beginnings of the jurisdiction of ICAO were marked by the Chicago Conference, in which early terms and regulations were decided upon, including the groundwork for aviation language safety measures. There were 54 nations that signed the original agreement on December 7th, 1944, and, as of 2018, all 192 member states have declared their compliance. There is a notable difference between ICAO's standards and their recommended practices, the former being a required procedure or policy considered *necessary* to aviation safety, and the latter being "*desirable in the interest of safety*" (Friginal, et. al. 2020, 32). In regards to language, being able to demonstrate "...*the ability to speak and understand the language...*" to a specific degree is a standard, and specifications as far as levels of proficiency and (re)testing are considered recommended practices (Friginal, et. al. 2020).

ICAO has divided its standards based on pronunciation, structure, vocabulary, fluency, comprehension, and interactions (see Appendix A). These determining factors then rank pilots between six levels of proficiency that include, from one to six, pre-elementary, elementary, pre-operational, operational, extended, and expert. The standards used today have been developed by linguistic professionals and pilots in an attempt to provide a comprehensive system of determining eligibility to manage aviation operations while mitigating an appropriate amount of risk that would be derived from the human factor consideration of language proficiency. After the standards were developed, each ICAO member country was provided the end-goal criteria

and recommendations on how to effectively train pilots to meet these standards are being released as well. Again, it is important to bear in mind that these are considered recommended practices only, and because of this, there has been a wide range of differing levels and types of applications of the standards. The variable implementation of these standards, training paradigms, and testing regimens, has resulted in many critiques and even have noted the potential risk for accidents.

To offer one example of how one country has chosen to implement the ICAO standards, the United States' aviation governing body, the Federal Aviation Administration's (FAA) version of the implementation of these standards is seen in the Advisory Circular (AC) 60-28B which discusses expectations of testing standards and licensing procedures. This AC references ICAO requirements and recommended practices by then placing them in the context of United States aviation and licensing standards. This document requires that pilots must be evaluated by the FAA Aviation English Language Standards (AELS) before being permitted to apply for their student pilot license or be endorsed by their instructor to fly solo. Provided in this document are expected jurisdictions for testing and determining whether a pilot can comply by the ICAO standards to read, speak, write, and understand the English language. This AC specifies that pilots must be able to "communicate in a discernable and understandable manner with air traffic control" (Federal Aviation Administration 2017). Specifications for what this standard level of communication signifies are based upon Appendix 1 of ICAO Annex 1, which bases comprehension on pronunciation, structure, vocabulary, fluency, comprehension, and interactions (ICAO 2018). ICAO has also provided Circular 323 which provides recommendations in regards to actual testing procedures. These recommendations establish a basis for how countries should implement training practices as well as expectations for the

personnel in charge of training the pilots to meet ICAO Level 4 Language Proficiency or higher (See Appendix A). This standard level of proficiency is considered to promote safe operations of aircraft and is considered a practical and achievable level (Mathews). With the recommended curriculum, member countries have a clearer idea of delivery methods and training materials that allow for the most effective Aviation English teaching system (ICAO 2009). Even with developing standards being established, accidents and incidents that can be attributed to language in any way necessitate further research being conducted to mitigate risk factors.

Aviation accidents are always a catalyst for new regulations, standards, or adjustments in operations within the field. These reactive measures allow aviation safety experts to explore causal factors in incidents and develop a safer industry culture. As the aviation industry continues to rapidly develop, so too has the interest in human causal factors, one of these being language proficiency. Although a new field, there are several accidents that have cited miscommunications or the inability to communicate as a causal factor, necessitating further investigation into the developing field of aviation linguistics.

**Table 1: Accidents and Standards Influenced by Linguistic Issues**

Year	Developments	Accidents
1951	Chicago Conference	
1977		Tenerife, Spain
1995		Cali, Colombia
2003	ICAO Language Standards	
2008	ICAO compliance deadline	

Several fatal accidents that have been critically evaluated found errors that occurred in communication before the actual occurrence of an accident. These accidents might have been

prevented if it weren't for language comprehension issues. For example, in the 1995 fatal accident involving a Boeing 757, 163 people were killed in Cali, Colombia in an accident that can be partially attributed to miscommunications involving a native Spanish speaking air traffic controller and a native-English speaking crew. Although the accident report lists faulty navigation as the primary cause of the accident, it is evident that clear communication might also have helped prevent the accident from occurring (from the NTSB report cited in Tajima 2004). The accident investigating body, the National Transportation Safety Board (NTSB) made a recommendation to the FAA stating that they should “Develop, with air traffic authorities of member states of the International Civil Aviation Organization, a program to enhance controllers' fluency in common English-language phrases and interaction skills sufficient in assisting pilots to obtain situation awareness about critical features of the airspace, particularly in non-radar environments.” The Air Traffic Controller (ATC) was fluent in Spanish and spoke English in the context of aviation, but there were clear language barriers that manifested, especially when an emergency situation began to unfold, and the limited “Aviation English register” was no longer sufficient to communicate during the dire situation (NTSB 1996). During a second investigation of this accident, the ATC on duty reported that “had the pilots been Spanish-speaking, he would have told them that their request made little sense and that it was illogical and incongruent. He said that because of limitations in his command of English, he was unable to convey these thoughts to the crew” (Bourgeois, et. al. 2007). Even ICAO's document addressing the implementation of standards recognizes that “no set of standardized phraseologies can fully describe all possible circumstances and responses” (ICAO 2010). Languages other than English are commonly spoken when both the pilot and ATC speak the same language, but Annex 10 recommends that “English be made available whenever an aircraft station was unable to

communicate in the language used by the station on the ground.” Colombian controllers are under the jurisdiction of the Aeronautica Civil Communications, which is in accordance with Annex 10 (ICAO 2001).

When both pilots and ATC speak the same language, the Convention on International Civil Aviation assessed that “The primary means for exchanging information in air-ground communications is the language of the ground stations, which will in most cases be the national language of the state responsible for the station.” (Ladkin 1996, 22). However, as the international language of aviation is English, it mandates that “English language will be available in a universal medium for radiotelephony communications.” Even this documentation acknowledges, however, that “It is always possible that an emergency may require communication with a ground station not foreseen in the original planning, and that the handicapping or prevention of such emergency communications by the lack of a language common to the flight crew and the ground station could lead to an accident” (ICAO 2001). In an interview with the ATC on duty at the time of the Cali, Colombia accident, he stated that “his fluency in non-aviation English was limited and he could not ask them to elaborate on the request” even though the navigational request of the pilots did not make sense to him (NTSB 1996). He also said that he would have felt more comfortable asking the pilots to elaborate and respond to more detailed questions regarding the routing if they had been native Spanish speakers. This unfortunate incident demonstrates that even when language may not be the primary cause of an accident, crucial breakdowns that are contributing factors to accidents can be attributed to linguistic factors.

In 1977, an accident in Tenerife, Spain caused by the collision of two Boeing 747s resulted in the loss of 583 lives and is, to date, the deadliest aviation accident. Although there

were many factors contributing to the intersecting paths of the Pan Am and KLM aircraft, including fog and a lack of adequate ground surveillance system, an overarching contribution to the chaos was a disheartening lack of language comprehension by both pilots and controllers. The pilot of the KLM was Dutch and reported to the ATC at Tenerife “We are now at takeoff” rather than using standard aviation radio phraseology which would have correctly been reported as “taking off.” If correctly relayed to ATC, the controllers would have known the plane was in the process of actually taking off, rather than just in a position where they were ready to take off, and could have made a clear attempt to stop the plane's takeoff (Ducar 2003). Instead, the imminent accident was not able to be recognized until it was too late, and the planes inevitably collided.

These linguistic misunderstandings resulted in the two aircraft being on the runway at the same time, with the KLM pilots believing they had been cleared for takeoff. The fault for much of the misunderstanding was the result of a confusion regarding prepositions. Even intricate details in language can cause perilous situations to occur, and prepositions are typically one of the last language aspects that language learners are able to master (Gass et. al. 2001, 22) When pilots and ATC speak different native languages, often their ability to communicate within the aviation register is limited. As the report regarding this accident states “The dangers of non-standard or abbreviated clearances are clear; maintaining clearance discipline under severe time constraints, however, is a constant struggle” (Division of Aerospace 1978, 110).

With aviation being one of the most regulated fields, safety culture is extremely critical, and regulations must adapt to fill the needs within the industry to ensure flights are conducted with minimal human error. Often the industry has had to be reactive in their decision making, especially with the international use of English as the recognized professional register of aviation

occurring fairly recently. The goal, however, is to become increasingly proactive with regulations that actively prevent incidents rather than evaluate why an accident happened and try to narrow down the margin of error. To be proactive, it is crucial that not only are incidents evaluated to determine the cause, but that researchers investigate the potential for accidents within a specific context. The aviation industry has expanded rapidly, with the globalization of air travel happening at a faster rate than preventative safety regulations can develop. In an effort to transform human factors studies in relation to aviation linguistics from a strictly reactive effort to a more proactive attempt, research is now being conducted on the language standards themselves as well as the testing of these standards and the implementation processes of training and testing practices.

A significant number of studies have been done that assess the relationship between communication within an aviation context and accidents that have occurred due to lack of proficiencies or other communication breakdowns (Hyejeong 2016, 2018, Tajima 2004). A majority of these studies are recent considering the decision to establish a worldwide official language of aviation is relatively recent, beginning only in the early 2000s; continuous changes are constantly shifting the industry. Always striving to improve safety, new regulations are constantly being created and evaluated to mitigate as much risk as possible.

Many of the existing studies tend to focus on a specific linguistic aspect or a specific language; this topic as a whole is too broad to evaluate with a single research study. A significant amount of these investigations have been done with a central focus on Korean and Chinese pilots and their use of English within the aviation context. A number of these studies focus on a specific section of discourse between pilots and air traffic control to evaluate specific situations in which language breakdown has occurred and use this to determine how preventative measures

could be instituted. These interactions prove that even errors that initially seem minute can create larger incidents that can lead to accidents and sometimes fatal miscommunications, as evident in the Tenerife accident and the pilot's misuse of prepositions.

Since the establishment of the ICAO regulating standards, many studies have evaluated the efficiency of these standards in an attempt to find weaknesses in the testing and evaluation methods that could be improved upon to increase overall aviation safety. Testing is completed in a format that is not realistic or entirely applicable to the real-world setting, which limits the effectiveness of using these standards to determine whether a pilot should be eligible to fly internationally. While the levels of proficiency are relatively comprehensive, enough to be put into practice in a generally world-wide context, there are communication breakdowns that still arise and the manifestation of these testing and communication errors is a testament to the need for improvement in the linguistic aspect of aviation. Studies that evaluate fatal miscommunications have helped improve the industry but are limited in that they are only able to evaluate what has already happened in specific circumstances rather than investigating root issues that could lead to prolonged change (Tajima 2004). Aviation has advanced extremely rapidly and with the accelerated growth, typically organizations within the industry are forced to be reactive with the creation of regulations rather than proactive, as would be preferred to protect the lives that are at stake every time an aircraft is in motion.

### **Methodology**

Given the gravity of the importance of communication in international air space, and its impact on flight safety, this study investigates the use of Spanish and English in aviation, the potential effect of proficiency in the cockpit, as well as issues that a lack of proficiency might cause, in the hopes of providing potential solutions. To investigate these issues, we sought out bilingual pilots whose native language is Spanish and who speak English as a second language, from North, Central and South America. This participant pool provides us with a better understanding of pilots that may only use English inside the workplace, or learned English for the specific purpose of becoming a pilot. All activities were conducted in either English or Spanish, according to participants' preference. The results were then evaluated to determine if additional safety measures could be put into place. Collecting data regarding language usage can help clarify whether acquiring a language from a source outside aviation relates to a higher comprehension of the language overall. With standard aviation phraseology including approximately 400 words, pilots trained in this register are equipped with only a limited amount of vocabulary skills that might fall short of what is required to communicate in a non-standard situation such as in an emergency.

In order to better understand the interactions between crew members in the air craft and between crew members and Air Traffic Control (ATC), this study investigates the pilot's comfort level when writing, speaking, reading, and attempting to understand the English language. To this end, pilots were surveyed and asked to explain their experiences with both languages inside and outside of the workplace. The survey asked pilots to reflect on miscommunications in the air and on the ground in their own personal experiences and during the different stages of flight.

The survey aims to answer the following research questions:

1. How does exposure to English influence pilots' level of self-efficacy of English proficiency in the cockpit?
2. How do language proficiency and exposure relate to self-efficacy toward proficiency in specific flight contexts?
3. With what frequency are pilots exposed to their native language while performing aviation duties and what effect does this have on their ability to perform their duties?

This study also investigates situations in which pilots and ATC tend to utilize their native language while in the cockpit. Questions in the survey address whether standardized procedures for these bilingual pilots are provided in English or in their native language. Asking pilots to complete a relatively simple survey allowed me to collect a larger amount of data which allowed for an analysis of comparisons and patterns between data sets.

Participants read a consent form and upon agreeing to complete the study, were directed to the survey questionnaire which was presented in an online format using the Qualtrics platform. Participants then responded to a series of questions that evaluated how comfortable they feel in the cockpit using both languages as well as what role each language plays in their life both inside and outside of the workplace. The initial questions use a six-point Likert scale to investigate how comfortable the pilot feels in a given circumstance when considering their language proficiency. The scale range included *extremely comfortable*, *moderately comfortable*, *slightly comfortable*, *slightly uncomfortable*, *moderately uncomfortable*, and *extremely uncomfortable*. Questions included in this section aim to rate a pilot's self-efficacy regarding their own proficiency inside of the cockpit, related to how well they understand and can utilize the English language during different phases of flight. Questions then evaluated the frequency in

which a pilot would typically hear both English as well as their native language over the radio, relating to the third research question, and whether they had experience flying with someone who had a different native language than them, or if all their flight experience had been with someone else who spoke Spanish as a native language. The survey also addressed whether the pilot had ever felt a lack of situational awareness resulting from either their own or someone else's language proficiency, a direct indicator that language plays a crucial role in flight safety. Also emphasizing the role of language, pilots were asked which language they prefer to use in the cockpit, and in which flight situations they feel most and least comfortable hearing English in the cockpit. They were also asked if there was ever a time where they didn't speak up because they couldn't say what they needed to in English; this relates directly back to the second research question regarding a pilot's ability to perform in the cockpit based upon their language abilities. These initial Likert scale-based questions were then followed by a series of demographic questions in order to obtain a more complete picture of pilots' experiences both with aviation and the languages they speak. As part of the demographic questions, pilots were asked questions regarding their use of English and experience with the language outside of an aviation setting, allowing results to reflect on the first research question and provide background data to how comfortable a pilot feels and how this relates to their overall grasp on the language. Pooling these responses showed patterns between language acquisition, and pilot self-efficacy with English competency as well as how comfortable the pilot feels in the cockpit.

The survey questions allowed the researcher to gain a general understanding of the pilots' language background as a testament to their ability to communicate in each language and then lead to inferences on their level of comfort performing tasks in each language. For this reason, the survey asked demographic data relating to how long the pilot had spoken English, how long

they had been in aviation (and exposed to aviation English), as well as in what scenarios outside of aviation they are exposed to English.

## Results

The participant pool reflected a varied population of Spanish speaking pilots in terms of levels of experience both with aviation as well as language comprehension specifically. Since the survey required pilots to be native Spanish speakers, questions assumed their proficiency in Spanish and then asked questions regarding how comfortable they feel in English and what their experience levels were regarding the use of English both in the field of aviation and beyond. Not only did the participants' country of origin vary, but so too did their experiences with English, allowing conclusions to be drawn between proficiency and how comfortable a pilot feels operating an aircraft.

Out of 23 total participants, the pilots who took the survey currently live in countries such as Mexico, the United States (with several from Puerto Rico), Costa Rica, Ecuador, Chile, Colombia, and France. The number of years pilots had spoken English proportional to their age varied greatly, and related directly to where they had learned English and for what purpose.

Several questions from the survey addressed the first research question regarding how exposure to English influences levels of self-efficacy and proficiencies in the cockpit. Of the pilots surveyed, 26% responded that they learned English for the specific purpose of aviation. Within this percentage, there was a varying amount of experience with English outside of the workplace, indicative of the various levels of comfort pilots reported for performing specific aviation-related tasks. When asked to fill in the statement "I speak English..." with answer responses including *very well*, *well*, *a little*, and *not well*, one respondent indicated that they spoke English *a little*, with the rest responding with *well* or *very well*. This respondent that not only rated their English as the lowest among respondents, but also responded in lower levels of proficiency in other questions relating to language comprehension as well. Within the

quantitatively based questions, participants were more likely to respond that they were only *slightly comfortable* or *moderately comfortable* in certain flight scenarios related to English, which was at the lower end of all pilots who took this survey. Pilots also tended to rank their ability to speak Aviation English higher than their ability to speak English in general, providing evidence that indicates when non-native English-speaking pilots are required to utilize language outside of the aviation register, such as during the circumstances of the Cali, Colombia accident, limited English proficiency can decrease overall situational awareness and ability to respond appropriately.

Of interest is the way in which pilots learned English, the purpose they had in learning English, and the ways in which they use English outside of the workplace. Only 39% of participants responded that their flight lessons were conducted in English, leaving the rest of the participants with flight lessons conducted either completely in Spanish, both Spanish and English, or a completely different language. When asked if the pilots spoke English outside of the workplace, 35% of the respondents replied *sometimes*, and 13% replied *never*, leaving 48% of participants that have little to no experience with English outside of aviation. These results indicated that although some pilots did have experience with the language outside of flying, there are pilots whose only exposure to English is when performing flight duties, therefore limiting their experience to English that is used outside of the aviation register.

By understanding the context of participants' overall proficiency, this leads into the second research question which addresses how these proficiencies and exposure relate to pilots' self-efficacy in specific flight contexts. When asked if there was ever a time in which the pilots did not speak up because they did not feel like they could say what they wanted to in English, 65% responded *no*, but 35% responded *yes*, indicating that the degree of comfort in

communicating and performing in the cockpit is being limited by lack of language proficiencies. While the majority of the pilots that took this survey, 83%, stated that they have never been in a situation where their language proficiency has caused a lack of situational awareness, even the few respondents that answered they have is an indication that there needs to be an improvement in how language proficiency is addressed and how important it is considered to be in the pilot training process.

Of the pilots surveyed, 17% reported having been in a situation where their own language proficiency caused a lack of situational awareness, and 52% reported that at some point someone else's language proficiency had caused a lack of situational awareness, clearly necessitating further measures be taken regarding the use of language within aviation. In addition, 52% of the participants have flown with someone whose native language was different from their own, and 26% reported feeling less comfortable communicating with them.

To evaluate the implications of the results of the pilots who reported having experienced a lack of situational awareness due to language proficiency, their responses were analyzed based upon their language acquisition experiences, as well as their responses to how comfortable they felt in each flight scenario. These pilots' responses indicated they were only slightly comfortable with the use of English while performing flight duties, and occasionally moderately comfortable hearing English in the cockpit rather than speaking it. These pilots were more likely to respond that they either *always* or *often* hear Spanish over the radio, and that they would prefer to use Spanish while in the cockpit. Most of the pilots that responded this way had learned English for the specific purpose of becoming a pilot and all of them had limited use of English outside of the workplace. Typically, their flight lessons were conducted in Spanish. Also interesting is that one of the respondents who had been less situationally aware because of language also responded

that they spoke English *A Little*, but that they spoke Aviation English *Very Well*. This disconnect in the way pilots rate themselves and their own English proficiency is indicative of the types of discrepancies that future training procedures need to take into consideration in order to best teach English to future pilots.

Regarding the third research question that inquired with what frequency pilots are exposed to their native language while performing aviation duties and what effect this has on their abilities, results found by this survey clearly demonstrate that Spanish is omnipresent in the field of aviation throughout the Western Hemisphere. Of the participants of this survey, 96% of the pilots responded that they either *always*, *often*, or *sometimes* hear their native language, and only 4% of participants report never hearing Spanish. This question only takes into consideration transmissions between pilots and ATC and doesn't even take into consideration pilot to pilot interactions as well. According to the data pooled, Spanish is heard across all traffic zones including high, medium and low, with participants ranking high traffic zones as the place where they have most often encountered their native language being used to communicate between pilots and controllers. While checklists and placards, however, are almost always provided in English, the language in which pilots are expected to be able to perform, almost half of respondents, 48%, noted that they prefer to use their native language while inside of the cockpit.

The implications of this study are limited in that this investigation did not take into consideration air traffic controllers' perspectives and instead focused on pilots alone. Language proficiency must go both ways when pilots and ATC are making radio calls back and forth, and both sides of the communication must be taken into consideration.

### **Recommendations for Future Research**

Quantitative data is limited in that it does not provide a complete picture for how comfortable a pilot would consider themselves in each scenario and how well they actually perform in specific scenarios where their language proficiency and ability may be tested. Using the data from the investigation, it would also be beneficial to gather information from specific scenarios that have occurred and investigate conclusions that could be drawn connecting these scenarios to each individual's experience with language. A smaller population could be utilized to expand upon the questions asked within the survey. These elaborated responses would combine the data from the Likert scale survey as well as the demographic information that was collected and connect these responses to open-ended responses regarding realistic in-flight scenarios, in the hopes of combining the two data sets to provide more in-depth comparisons.

Another possibility would involve interviewing participants. Interview questions that ask pilots to share specific instances in which they may have felt uncomfortable due to a lack of language proficiency could be used to allow the pilots to elaborate on their initial responses. The interview also allows the opportunity to reflect on pilot training and linguistic factors that relate to whether the pilot learned English for training or for a different purpose, as well as whether conducting flight training in English or Spanish benefits the pilot or puts them at a disadvantage in real world situations. Following up with an interview with interested participants would provide an extra level of qualitative data as well as examples of specific situations in which breakdowns have occurred. A sample selection of potential interview questions is included in the Appendix of this paper (See Appendix D).

Another area where research on this topic is lacking is the implementation of ICAO standards in different member countries. After ICAO released the standards and levels of

proficiencies required, countries were left to determine their own testing and accreditation process, which functioned more efficiently in certain countries compared to others.

Understanding how the different processes of implementation relate to overall pilot proficiency levels within a country could allow conclusions to be drawn on the most effective ways to teach aviation English and how testing and accreditation could be improved in countries where proficiency is lacking. Research in this field is limited overall and tends to focus on specific regions when it is conducted. To have a more clear overall picture, research needs to be completed in a wider variety of countries across a wider array of languages.

To better understand English proficiency specifically related to accidents, research could also be conducted related to how multilingual pilots respond specifically in emergency situations. Evaluating whether a pilot's tendency in a high stress scenario is to return to their native language or to utilize English, the language aviation activities are expected to be conducted in, would prove interesting and aid in determining the best approach to aviation English training. As in the case of the Cali, Colombia accident, and as demonstrated by the results of the survey in this study, it is critical that pilots or others involved in aviation are not limited in their ability to convey to others the full extent of an emergency because of a linguistic barrier.

### **Conclusion**

From previous research as well as from contributions from this investigation, it is evident that even after the implementation of standards, lack of English proficiency still exists at all levels of aviation and poses a significant risk factor to safe aircraft operations. Acquiring language from a source outside of aviation, or having experience using English outside of the aviation workplace can contribute to a higher comprehension of language overall, and a higher

level of presumed proficiency. Due to the hazards misuse of language presents, studies should continue to be conducted, and education on this issue must be increased.

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Appendix A: ICAO Language Proficiency Standards Criteria

LEVEL	PRONUNCIATION <i>Assumes a dialect and/or accent intelligible to the aeronautical community.</i>	STRUCTURE <i>Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task.</i>	VOCABULARY	FLUENCY	COMPREHENSION	INTERACTIONS
Expert 6	Pronunciation, stress, rhythm, and intonation, though possibly influenced by the first language or regional variation, almost never interfere with ease of understanding.	Both basic and complex grammatical structures and sentence patterns are consistently well controlled.	Vocabulary range and accuracy are sufficient to communicate effectively on a wide variety of familiar and unfamiliar topics. Vocabulary is idiomatic, nuanced, and sensitive to register.	Able to speak at length with a natural, effortless flow. Varies speech flow for stylistic effect, e.g. to emphasize a point. Uses appropriate discourse markers and connectors spontaneously.	Comprehension is consistently accurate in nearly all contexts and includes comprehension of linguistic and cultural subtleties.	Interacts with ease in nearly all situations. Is sensitive to verbal and non-verbal cues and responds to them appropriately.
Extended 5	Pronunciation, stress, rhythm, and intonation, though influenced by the first language or regional variation, rarely interfere with ease of understanding.	Basic grammatical structures and sentence patterns are consistently well controlled. Complex structures are attempted but with errors which sometimes interfere with meaning.	Vocabulary range and accuracy are sufficient to communicate effectively on common, concrete, and work-related topics. Paraphrases consistently and successfully. Vocabulary is sometimes idiomatic.	Able to speak at length with relative ease on familiar topics but may not vary speech flow as a stylistic device. Can make use of appropriate discourse markers or connectors.	Comprehension is accurate on common, concrete, and work-related topics and mostly accurate when the speaker is confronted with a linguistic or situational complication or an unexpected turn of events. Is able to comprehend a range of speech varieties (dialect and/or accent) or registers.	Responses are immediate, appropriate, and informative. Manages the speaker/listener relationship effectively.
Operational 4	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation but only sometimes interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere with meaning.	Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete, and work-related topics. Can often paraphrase successfully when lacking vocabulary in unusual or unexpected circumstances.	Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication. Can make limited use of discourse markers or connectors. Fillers are not distracting.	Comprehension is mostly accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. When the speaker is confronted with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies.	Responses are usually immediate, appropriate, and informative. Initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming, or clarifying.
Pre-operational 3	Pronunciation, stress, rhythm, and intonation are heavily influenced by the first language or regional variation and frequently interfere with ease of understanding.	Basic grammatical structures and sentence patterns associated with predictable situations are not always well controlled. Errors frequently interfere with meaning.	Vocabulary range and accuracy are often sufficient to communicate on common, concrete, or work-related topics, but range is limited and the word choice often inappropriate. Is often unable to paraphrase successfully when lacking vocabulary.	Produces stretches of language, but phrasing and pausing are often inappropriate. Hesitations or slowness in language processing may prevent effective communication. Fillers are sometimes distracting.	Comprehension is often accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. May fail to understand a linguistic or situational complication or an unexpected turn of events.	Responses are sometimes immediate, appropriate, and informative. Can initiate and maintain exchanges with reasonable ease on familiar topics and in predictable situations. Generally inadequate when dealing with an unexpected turn of events.
Elementary 2	Pronunciation, stress, rhythm, and intonation are heavily influenced by the first language or regional variation and usually interfere with ease of understanding.	Shows only limited control of a few simple memorized grammatical structures and sentence patterns.	Limited vocabulary range consisting only of isolated words and memorized phrases.	Can produce very short, isolated, memorized utterances with frequent pausing and a distracting use of fillers to search for expressions and to articulate less familiar words.	Comprehension is limited to isolated, memorized phrases when they are carefully and slowly articulated.	Response time is slow and often inappropriate. Interaction is limited to simple routine exchanges.
Pre-elementary 1	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.

Source: 'Manual on the Implementation of ICAO Language Proficiency Requirements', International Civil Aviation Organization (2004).

**Appendix B: FAA Advisory Circular for English Language Standards**

- [ICAO Standards](#):
  - (2) 3. Vocabulary. The applicant's vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete, and work-related topics. The applicant can often paraphrase successfully when lacking vocabulary in unusual or unexpected circumstances. ...
  - (2) 4. Fluency... There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication.
  - (2) 5. Comprehension. Comprehension by the applicant is mostly accurate on common, concrete, and work-related topics when the dialect, accent, or variety used is sufficiently intelligible. When the applicant is confronted with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies.
  - (3) 6. Interactions. Responses by the applicant are usually immediate, appropriate, and informative. The applicant initiates and maintains exchanges even when dealing with an unexpected turn of events. The applicant deals adequately with apparent misunderstandings by checking, confirming, or clarifying.

### Appendix C: Study Survey

Overall, how comfortable do you feel hearing English in the cockpit?

En general, ¿cuán cómodo se siente al escuchar inglés en la cabina?

- Extremely comfortable / muy cómodo
- Moderately comfortable / bastante cómodo
- Slightly comfortable / ligeramente cómodo
- Slightly uncomfortable / un poco incómodo
- Moderately uncomfortable / modernamente incómodo
- Extremely uncomfortable / muy incómodo

Overall, how comfortable do you feel speaking English in the cockpit?

En general, ¿cuán cómodo se siente al hablar inglés en la cabina?

- Extremely comfortable / muy cómodo
- Moderately comfortable / bastante cómodo
- Slightly comfortable / ligeramente cómodo
- Slightly uncomfortable / un poco incómodo
- Moderately uncomfortable / modernamente incómodo
- Extremely uncomfortable / muy incómodo

How often do you hear Spanish over the radio?

¿Cuán frecuentemente escucha español por la radio?

- Always / siempre
- Often / frecuentemente
- Sometimes / algunas veces
- Never / nunca

Where do you most often hear Spanish over the radio?

¿Dónde escucha español más por la radio?

- High traffic zones / zona de alto tráfico aéreo
- Medium traffic zones / zona de medio tránsito
- Low traffic zones / zona de poco tránsito

In which regions are you most likely to hear Spanish over the radio? (check all answers that apply)

¿En cuales regiones escucha español con más frecuencia por la radio?

- Northern United States / parte norte de los Estados Unidos
- Southern United States / parte del sur de los Estados Unidos
- Central America / america central
- South America / america del sur
- Spain / España

What languages are checklists most often provided to you in?

¿En qué idioma se le proporcionan más a menudo las listas de verificación?

- English / inglés
- Spanish / español
- Other / otro

Are different checklists provided in different languages? (e preflight checklists, startup checklists, emergency checklists...

¿Se les proporcionan las listas de verificación diferentes en idiomas diferentes? Por ejemplo los de previo al vuelo, encendido de motores, o de emergencia...

- Yes / Sí
- No

What language do aircraft placards usually appear in?

¿En qué idioma aparecen los letreros normalmente?

- English / inglés
- Spanish / español
- Other / otro

Overall, how comfortable do you feel using English on the ground while performing aviation related tasks? (preflight/taxiing)

En general, ¿Cuán cómodo se siente al usar el inglés en la tierra cuando está desempeñando un trabajo en relación a la aviación? Por ejemplo previo al vuelo o rodaje

- Extremely comfortable / muy cómodo
- Moderately comfortable / bastante cómodo
- Slightly comfortable / ligeramente cómodo
- Slightly uncomfortable / un poco incómodo
- Moderately uncomfortable / modernamente incómodo
- Extremely uncomfortable / muy incómodo

When I hear English in the cockpit I feel..

Cuando escucho inglés en la cabina, me siento...

- Extremely comfortable / muy cómodo
- Moderately comfortable / bastante cómodo
- Slightly comfortable / ligeramente cómodo
- Slightly uncomfortable / un poco incómodo
- Moderately uncomfortable / modernamente incómodo
- Extremely uncomfortable / muy incómodo

Has your language proficiency ever caused a lack of situational awareness?

¿En algún momento su competencia lingüística ha causado una carencia de percepción circunstancial?

- Yes / sí
- No

Has someone else's language proficiency ever caused a lack of situational awareness?

¿En algún momento la competencia lingüística de otra persona ha causado una carencia de percepción circunstancial?

- Yes / sí
- No

At which stage of flight do you feel most comfortable using English?

¿Durante cuál etapa del vuelo se siente más cómodo con el uso de inglés?

- Taxi / rodaje
- Takeoff / despegue
- Cruise / vuelo de crucero
- Landing / aterrizaje
- Other / otro

At which stage of flight do you feel least comfortable using English?

¿Durante cuál etapa del vuelo se siente menos cómodo con el uso de inglés?

- Taxi / rodaje
- Takeoff / despegue
- Cruise / vuelo de crucero
- Landing / aterrizaje
- Other / otro

In the cockpit, which language do you prefer to use?

¿En la cabina, cuál idioma prefiere usar?

- English / inglés
- Spanish / español
- Other / otro

Have you flown with someone whose native language was different than yours?

¿Usted ha volado con alguien cuya lengua nativa era diferente que la suya?

- Yes / sí
- No

If yes, did you feel less comfortable communicating with them?

Si lo ha hecho, se sentía menos cómodo comunicándose con ellos?

- Yes / sí
- No

When considering crew conversations with pilots who speak different languages, which stages of flight are most difficult?

Al considerar conversaciones entre pilotos que hablan lenguas diferentes, ¿cuáles etapas del vuelo son las más difíciles?

- Taxi / rodaje
- Takeoff / despegue
- Cruise / vuelo de crucero
- Landing / aterrizaje
- Other / otro

Was there ever a time where you didn't speak up because you couldn't say what you wanted to in English?

¿Ha habido ocasiones en que usted no pudo expresar lo que quisiera expresar en inglés, y que por eso se calló?

- Yes / sí
- No

## **Demographics**

### **Demograficas**

How old are you?

¿Cuántos años tiene?

How long have you been a pilot?

¿Por cuántos años ha sido piloto?

How many total hours do you have?

¿Cuántas horas de vuelo tiene en total?

What type of aviation are you involved in?

¿En cuál tipo de aviación está involucrado?

- Commercial (airlines) / Comercial (aerolíneas)
- Cargo Charter / Vuelo chárter de carga
- Passenger Charter / Vuelo chárter de pasajeros
- Aerial Survey /inspecciones aéreas

- Military / militar
- General Aviation / aviación general
- Instructor
- Other / other

What licenses and ratings do you have?

¿Cuáles licencias o certificaciones tiene?

What position/rank do you hold?

¿Cuál posición o rango tiene?

I speak English \_\_\_\_\_.

Habla inglés \_\_\_\_\_.

- Very well / muy bien
- Well / bien
- A little / un poquito
- Not well / mal

I speak Aviation English \_\_\_\_\_.

Conoce el registro de aviación en inglés \_\_\_\_\_.

- Very well / muy bien
- Well / bien
- A little / un poquito
- Not well / mal

How/Where did you learn English? (check all that apply)

¿Cómo o dónde aprendió inglés?

- High school / colegio
- University / universidad
- At home / en la casa
- Aviation training / entrenamiento
- Church / iglesia
- Other / otro

¿Aprendió inglés con el propósito específico de hacerse piloto?

- Yes / sí
- No

Were your flight lessons conducted in English or Spanish? Or other...?

¿Se realizaron sus lecciones de vuelo en inglés o español?

- English / inglés
- Spanish / español
- Both / ambos
- Other / otro

How long have you spoken Spanish?  
¿Por cuánto tiempo ha hablado español?

How long have you spoken English?  
¿Por cuánto tiempo ha hablado inglés?

Do family members ever speak English to you?  
¿Su familia habla inglés con usted?

- Always / siempre
- Often / frecuentemente
- Sometimes / algunas veces
- Never / nunca

Do you ever speak English to your family members?  
¿Usted habla inglés con su familia?

- Always / siempre
- Often / frecuentemente
- Sometimes / algunas veces
- Never / nunca

What is the highest level of education you have completed?  
¿Cuál es el máximo nivel de educación que usted ha completado?

- High School Diploma / Graduado con título secundario
- Bachelors / Bachillerato
- Masters / Maestría
- Doctorate / Doctorado
- Other / Otro

What country are you originally from?  
¿De cuál país es originalmente?

What country do you live in now?  
¿Dónde vive ahora?

Do you use English outside of the workplace?

¿Usa inglés fuera del trabajo?

- Always / siempre
- Often / frecuentemente
- Sometimes / algunas veces
- Never / nunca

Where do you speak English? (check all that apply)

¿Dónde habla inglés?

- Home / en casa
- Work (outside of aviation) / trabajo (además de la aviación)
- Church / iglesia
- School / escuela
- With friends / con amigos
- Travel / en viaje

**Appendix D: Proposed Interview / Entrevista for Future Research**

1. How frequently do situations occur in which you feel uncomfortable performing aviation related duties due to a lack of language proficiency?  
*¿Cuán frecuentemente ocurren situaciones en las cuales se siente incómodo al preformar las tareas aéreas debido a una carencia de competencia lingüística?*
2. Do you notice a lack of language proficiency more between pilots and crew or between pilots and air traffic control? Example?  
*¿Piensa que ha observado una carencia de competencia lingüística más entre los pilotos y la tripulación o entre los pilotos y el control de tráfico aéreo? ¿Nos podría ofrecer un ejemplo?*
3. Have you observed a situation or been involved in a situation in which language proficiency caused an emergency situation to occur that could have otherwise been avoided?  
*¿Ha observado una situación o ha sido involucrado en una situación en la cual la competencia lingüística causó una emergencia que pudiera haber sido evitada?*
4. At what point in your career did you begin to feel confident in your language proficiency?  
*¿En cuál punto de su carrera empezó a tener confianza en su competencia lingüística?*
5. Has the use of languages other than Spanish and English caused any in-flight difficulties?  
*¿El uso de lenguajes fuera de inglés y español ha causado dificultades en el vuelo?*
6. Do you feel more comfortable doing flights within Spain, Central or South America because Air Traffic Control can typically speak Spanish if an emergency were to occur?  
*¿Se siente más cómodo al hacer vuelos dentro de España, América del Sur o América Central porque el control de tráfico aéreo sabe hablar español en caso de una emergencia?*
7. During a routine flight, do you typically think in English or Spanish?  
*¿Durante un vuelo típico, piensa en inglés o español?*
8. If an emergency situation began to occur, would you be more apt to use English or use Spanish?  
*¿Si una situación de emergencia ocurriera, cuál sería su tendencia natural usar el inglés o el español?*