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U.S. Airline Transport Pilot International Flight Language Experiences, Report 1: Background Information and General/Pre-Flight Preparation

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16. Abstract

In 1998, the International Civil Aviation Organization (ICAO) took a heightened interest in the role of language in airline accidents. Its Air Navigation Commission was directed to complete the task of strengthening relevant ICAO provisions concerning language requirements. Member states agreed to take steps to ensure air traffic control (ATC) personnel and flight crews involved in flight operations in airspace where the use of the English language is required were proficient in conducting and comprehending radiotelephony communications in English. Since then, ICAO developed its English Language Proficiency (ELP) requirements and urged its Members to document their ELP test implementation plans by March 8, 2008. Until all ATC personnel and flight crews involved in flight operations obtain a passing level of ELP, the language-based problems international pilots face is not known. This report is a compilation of written responses and comments by a small focus group of 48 U.S. pilots of their difficulties in international operations. The focus group consisted of 12 international U.S. pilots from American, Continental, Delta, and United Airlines. Each focus group met with two interviewers to discuss their language experiences flying into countries where English may or may not be the local or national language among its radio operators, controllers, and pilots. In this report, the pilots' responses to 23 of the 64 multi-part questions and their comments from discussions of those questions with interviewers are presented as a compiled narrative. The pilots' responses had six major thrusts: (1) Cultural differences exert an important, nearly undetectable influence on international aviation; (2) English language proficiency is deficient and hampers effective communication; (3) Party-line (single-frequency) communications in English facilitate situational awareness. When mixed languages are on frequency, party-line communications pose a safety concern and impede situational awareness; (4) Pronunciation and naming conventions for locations and other identifiers lack a uniform pronunciation, and 3- or5-letter identifiers may not be connected with the pronunciation; (5) There is no uniform agreement as to what standard phraseology is or should be; and (6) Technological advancements such as datalink may help solve some of the language problems.

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EXECUTIVE SUMMARY

This is the first of several reports that will present the findings from in-depth interviews with pilots who fly internationally for major air carriers. The first series of reports are from small focus group discussions with 48 U.S. pilots. A second series used the same format and questions with pilots flying internationally for Aeroflot, Alitalia, China Air, and LAN Chile airlines.

English language proficiency is a safety concern, as noted by the International Civil Aviation Organization (ICAO, 2004). Given that international flight operations are increasing, it is important to know more about the language experiences U.S. pilots encounter when flying into countries where English may or may not be the local or national language among their radio operators, air traffic controllers, and pilots.

Several major U.S. airline companies were asked to solicit volunteers from among their international pilots to serve as paid subject matter experts in a structured interview constructed to assess the language difficulties they encounter during international flights. There were 12 pilots, each representing American, Continental, Delta, and United Airlines, for a total of 48 airline transport pilots (ATPs). These pilots were assumed to be representative of typical U.S. airline pilots flying internationally as to English language proficiency, familiarity with ICAO and aviation procedures, terminology, and standard air traffic phraseology. We limited the size of each focus group to include no more than 4 pilots. Morning and afternoon sessions took place over several days at each company's preferred location.

The structured interview was divided into 10 sections: (1) Background Information, (2) Pre-Flight Preparation, (3) Air Traffic Control (ATC) Procedures, (4) Word Meaning and Pronunciation, (5) Language Experiences in Non-Native English-Speaking Airspace/Airports, (6) Non-Native English-Speaking Controllers Communicating With Native English-Speaking Pilots, (7) Language Experiences in Native English-Speaking Airspace/Airports, (8) Native English-Speaking Controllers Communicating With Non-Native English-Speaking Pilots, (9) Communication Problems, and (10) Technological Intervention. A copy of the interview questions appears in Appendix A.

The responses to the first 23 questions (Section 1 and Section 2) provide a wealth of ideas related to the international flight experiences of the pilots who participated in small focus-group discussions. The pilots' answers to the questions and discussions during the interviews were their perception of the situations they encountered. Many stories were anecdotal, and some were relayed in third person. The analyses of those discussions and written responses are summarized and presented as if from one pilot's diary containing a compendium of flight experiences. This was done to preserve the richness and integrity of the information given during the interviews.

There are many topics that shared a common thread of information, and they have been organized, arranged alphabetically, and condensed here into six overriding themes.

Cultural differences exert an important, nearly undetectable influence on international aviation. In the United States and European countries, the pilot and the controller are partners in maintaining a safe flight. If a pilot requests an altitude below the minimum safe altitude, the controller will generally deny the request. However, there are some countries in which a pilot request for an altitude below the minimum safe altitude may be granted by the controller because the hierarchical structure is one in which the pilot is given a higher authority than the controller.

The focus groups reported that English language proficiency (ELP) often is deficient in non-native English countries and hampers effective communication. English language deficiency below a certain level hampers air traffic control communication. Language proficiency includes pronunciation, structure, vocabulary, fluency, comprehension, and interaction. Pilots spent considerable time discussing the difficulties they experienced communicating with radio operators and controllers who are non-native speakers of English. Pronunciation and fluency were primary factors that affected the ease of understanding, intelligibility, and comprehension of utterances.

Party-line (single-frequency) communications play an important role in situational awareness (SA) and in providing pilots with traffic information and clearances/frequencies to expect. When communications with radio operators and air traffic controllers is either not available due to lack of coverage or inadequate English language proficiency presents itself as a communication barrier, pilots share information about weather and turbulence with each other. Although the information might not be current, it is better than nothing.

When pilots and controllers talked with one another in the local language, U.S. pilots reported difficulty knowing when one speaker was finished talking and often would disrupt an ongoing dialogue, losing all radio protocol. Additionally, not understanding what was being said created a diminution of situational awareness that affected their sense of safety.

Pronunciation and naming conventions for locations and other identifiers (waypoints, fixes, etc.) lack a uniform pronunciation, and 3-to-5 letter identifiers may not be connected obviously with pronunciation. Also, some airports share the same name (though with different 3-to-5 letter identifiers) as nearby location identifiers, which can make it difficult for a pilot to understand his/her route. It may be that datalink applications will be able to provide textual route information that can be read and replayed with realistic synthetic speech. As noted during

the discussions, in many countries, several of the names of intersections sound alike to the pilots. Also, many non-native English-speaking controllers, while speaking English to the pilots, may say waypoint/intersection names in the local language pronunciation. This pronunciation may not be clear to the pilot and may require requests for repeats until it is understood.

Application of standard ICAO phraseology is not uniform across countries, creating ambiguity for the pilot as to how some ATC instructions, clearances, or commands are to be executed. Pilots consistently used the "cleared direct" example as part of a clearance. When U.S. pilots hear foreign controllers use "cleared direct," the crew may think the controller wants them to fly direct to a point or fix (as they would if in the U.S.); in actuality, the foreign controller interprets the clearance as "fly the filed route."

Technological advancements such as data communications may solve part of the language problem internationally, but with a loss in situation awareness. ADS-B applications, such as the cockpit display of traffic information (CDTI), may be able to augment situation awareness by providing pilots with real time aircraft actions and trajectories. While most pilots saw datalink as a partial solution to solving the pronunciation, accent, speech rate, and other problems, they did not see it as a panacea for all the communication problems.

Presently, some Airbus datalink systems provide pilots with the capability to input their gate-to-gate clearances, while other aircraft require the pilot to change those clearances when entering into the US. Likewise, aircraft lacking the capability to build gate-to-gate clearances require pilots to input partial clearances provided by controllers along their flight path.

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United States Airline Transport Pilot International Flight Language Experiences, Report 1:

Background Information and General/Pre-Flight Preparation

We don't speak English — we speak American; so it's not the same language.
— U.S. pilot's comment

INTRODUCTION

The Federal Aviation Administration (FAA) is projecting major increases in the number of passengers arriving into, and departing from, the United States (U.S.) through the year 2017 (FAA, 2007a). As shown in Figure 1, the largest percentage of growth will involve the Asia/Pacific area followed by Latin America (including Mexico and the Caribbean). Included in its forecast (FAA, 2007a) is an average annual international travel growth rate of 5% per year beginning in 2007.

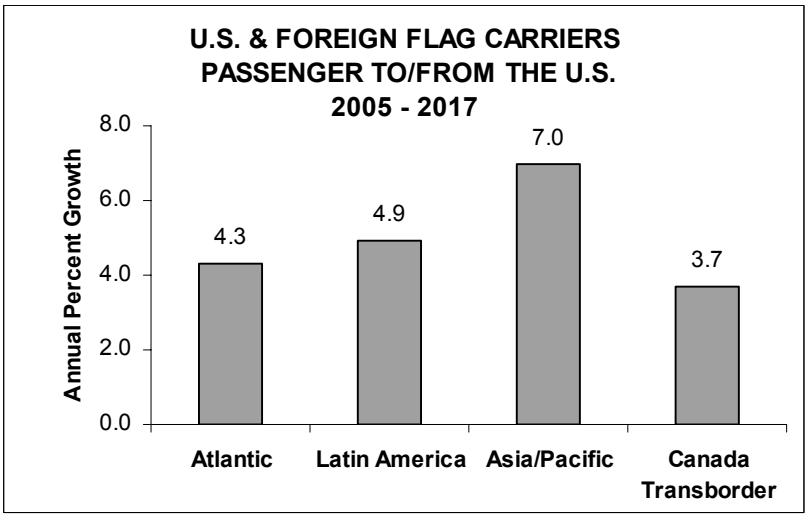

Figure 1. Projected Annual Growth in Passengers

The projected increase in passengers will create a demand for more airline flights. In anticipation, the *FAA Aerospace Forecast Fiscal Years 2007-2020* projects that by fiscal year 2020, the number of expected take-offs and landings at U.S.-towered airports may reach 81.1 million operations, growing by an average of 1.4 million per year during the forecast period. In addition, general aviation, or private flying hours, are expected to increase 59% by 2020.

As the volume of U.S. and foreign flagship carriers increases, so will the number of transmissions necessary to provide air traffic control (ATC) services. These services include clearances and instructions, as well as traffic and weather advisories, reports, and requests. Given that the present air-ground communications system is reaching pre-9/11 saturation levels during peak traffic periods, it is common for some controllers to send longer and more complex messages to reduce the number of times they need to communicate with individual aircraft (Prinzo, Hendrix, & Hendrix, 2006) and use non-standard phraseology to decrease the amount of time on frequency (e.g., go fast, good rate), or both. The ability to quickly decode, understand, read back, and comply with these messages can be a problem for all pilots, especially those who are unfamiliar with how ATC services are delivered by controllers in a particular region.

Airline transport pilots (ATPs) who have English as their second or third language may have difficulty understanding local nuances and lengthy clearances delivered at rapid rates. Likewise, native English-speaking pilots may encounter difficulties understanding the English spoken by English-speaking controllers or by non-native speakers of English. Reports from Brazil in recent months have pointed increasingly at controller error as the leading likely cause of an accident involving a Legacy business jet and a Boeing 737, which killed 154 people in 2006. Accident transcripts revealed the business jet pilots apparently had trouble understanding the English spoken by the Brazilian controllers. On three separate occasions, they asked for clarification without getting a satisfactory response (Associated Press, Feb. 19, 2007).

Likewise, controllers may have difficulty understanding the English spoken by native and non-native English-speaking pilots. For example, Kanu Gohain, Director General of Civil Aviation (DCGA) in India, told reporters that in 2006 India "sent home" between 20-25 pilots (mainly from the Commonwealth of Independent States and Eastern Europe) because their English posed safety concerns (Reuters, Feb. 15, 2007). The DGCA did not clear these foreign pilots to fly in India because they did not demonstrate proficiency in English in the oral exams.

Lack of proficiency in the English language among pilots and controllers who are non-native English speakers has resulted in fatalities,[1] mishaps, and unsafe acts (ICAO, 2004). In response, the International Civil Aviation Organization (ICAO), an agency of the United Nations, published in 2004 the *Manual on the Implementation of ICAO*

[1] As an example, in 1990, Avianca Flight 51 was making its third approach into JFK Airport and failed to inform air traffic control they had a fuel emergency and crashed.

Language Proficiency Requirements. The implementation of the ICAO language proficiency requirement is slated for March 2008.[2] Specifically, "Aeroplane and helicopter pilots and those flight navigators who are required to use the radio aboard an aircraft shall demonstrate the ability to speak and understand the language used for radiotelephony communications."[3] Similarly, "Air traffic controllers and aeronautical station operators shall demonstrate the ability to speak and understand the language used for radiotelephony communications."[4]

English language proficiency educational materials, training, and testing programs are being developed and implemented to meet the ICAO mandate. Clearly, the concern for aviation safety continues globally. Given that what is known about language-based communication problems is derived from accident, incident, and mishap reports, what is absent is an understanding of how prevalent these problems are during normal air traffic operations.

The available reports that describe operational communications between pilots and U.S. controllers were derived from voice tapes that were provided by tower (Burki-Cohen, 1995; Cardosi, 1994), terminal radar approach control (Cardosi, Brett, & Han, 1996; Prinzo, 1996), and enroute traffic control centers (Cardosi, 1993). Unfortunately, the existing reports (written a decade ago) do not provide any indication as to the magnitude or severity of communication problems that involve non-native English-speaking pilots who fly international commercial aircraft into the U.S., or by U.S. pilots who fly to international destinations. Consequently, an operational shortfall exists in our understanding of international operational communications as it occurs within the National Airspace System (NAS) and in foreign countries, and its perceived impact on safety by airline transport pilots.

Likewise, there is a lack of baseline data regarding the flight experiences of pilots who fly internationally. Not surprisingly, research is needed to identify and fill the gaps in communications data that would contribute to the understanding of some of the language issues, communication problems, and procedural differences airline transport pilots encounter when flying internationally. Also, as digital communications systems and their applications emerge, it is important to know which messages may present a problem for both native and non-native English-speaking pilots.

Therefore, the purpose of this series of studies is to identify language issues that are barriers to efficient and effective communication between the airline transport pilot (one group of native English-speaking pilots, one group of non-native English-speaking pilots) and air traffic controllers (who may or may not be fluent in English). In this first study, a total of 48 U.S. international airline transport pilots participated in small focus group meetings to discuss the types of communication problems they encountered during international flights. In the second study, 12 non-U.S. airline transport pilots (3 pilots from Aeroflot, Alitalia, China Airlines, and LAN Chile) participated in similar focus group meetings and provided answers to the same questions. The information gained from these studies will be available to various FAA workgroups involved in the design and certification of future avionics systems that provide controller/pilot datalink communications and other air traffic services.

The findings from these studies will appear separately for the U.S. and the non-U.S. pilots in a series of reports. We attempted to preserve the richness and breadth of the information provided during the interviews. This first report provides an analysis of the first two sections of the structured interview: (1) Background Information related to the recency of international flight experiences among the pilot participants and (2) General/Preflight Preparation. It covers the U.S. pilots' responses and discussions of questions 1-23. When possible, the content was tabulated and presented in tables. Their verbal discussions are combined, condensed, edited, and presented as a narrative from the perspective of a hypothetical, albeit typical ATP-rated pilot.

METHOD

Participants

A total of 48 U.S. pilots (12 pilots each from American, Continental, Delta, and United Airlines) participated in this study. All were selected by their respective companies and received remuneration from Acheson Consulting for their participation as paid subject matter experts. U.S. pilots flew an average of 15 yrs internationally (S.D. = 10 yrs, range = 1-36 yrs) and had an average of 5 international flights (S.D. = 6 flights, range = 0-35 flights) in the 30 days preceding the interviews.

Structured Interview Questionnaire

Pilots provided information pertaining to any problematic language-based communication, procedure, or observation they experienced or heard over their aircraft's communications system during international flights. The questions were developed by the first author, with expertise provided by several retired airline transport pilots, a member of the Proficiency Requirements in Common English Study Group (PRICESG), and several human factors research psychologists. The *Questionnaire Construction Manual* (Babbitt &Nystrom, 1989) was used to construct some of the questions and response alternatives.

A copy of the questionnaire was administered during a mock interview with three FAA employees who had

[2] In November 2007, the Assembly of ICAO drafted a resolution to precede Resolution A32-16 that would urge up to a 3-yr extension of the provisions in A32-16 and Article 40 of the Convention.

[3] Appendix A, Manual on the Implementation of ICAO Language Proficiency Requirements.

[4] Appendix A, Manual on the Implementation of ICAO Language Proficiency Requirements.

international piloting flight experience. During that meeting, participants commented on the understandability of individual items and critiqued the breadth, structure, and scope of the questionnaire as a whole. Their comments were incorporated into the final revision of the questionnaire.

The structured interview questionnaire was divided into ten sections with a total of 64 questions (q): (1) Background Information (q1-17); (2) General/Pre-Flight Preparation (q18); (3) ATC Procedures (q19-23); (4) Word Meaning and Pronunciation (q24-30); (5) Language Experiences in Non-Native English-Speaking Airspace/Airports (q31-38); (6) Non-Native English-Speaking Controllers Communicating With Native English-Speaking Pilots (q39-45); (7) Language Experiences in Native English-Speaking Airspace/Airports (q46-53); (8) Native English-Speaking Controllers Communicating with Non-Native English-Speaking Pilots (q54-59); (9) Communication Problems (q60-62); and (10) Technological Intervention (q63-64). A copy of the questionnaire is presented in Appendix A.

Procedure

Within one to two weeks preceding the scheduled interview, each pilot received a copy of the interview protocol and questionnaire. They were asked to respond to a set of language-based questions regarding their international flight experiences and consent to being audio recorded. If they agreed to participate in the structured interviews, they were to complete the 17-page questionnaire and return their responses to their airline's designated point of contact. Their responses were copied and made available to the interviewers for review prior to the interviews. The pilots had access to their completed questionnaires to aid the interview process. The interviews were conducted at the pilots' airline offices in the U.S.

There were no more than four pilots in each focus group, and each meeting with U.S. pilots lasted approximately 3.5 hr. Meetings with non-native English-speaking pilots took longer because their pilots were given longer breaks to allow them time to relax. Providing foreign pilots longer breaks allowed them to recover from the stress created by long flights, different time zones, and communicating in a non-native language. Upon completion of the interviews, the pilots' written responses and oral remarks were transcribed and incorporated into a database, along with the responses and remarks of the other pilot participants for analysis.

RESULTS

The results from the interviews with U.S. ATP pilots are presented by section and in the order in which the questions were asked during the structured interviews. Some of the pilot discussions of a particular question appeared to address similar topics with an underlying issue or concern. Consequently, those topics were grouped together and the core issues or concerns extracted and labeled. Topics within an issue or concern are presented alphabetically, as is the issue or concern.

Section 1: Background Information

3. Which countries' airspace have you flown through in the past three (3) months?

As shown in Table 1, the U.S. pilots listed 64 geographical areas. Canada, England, and Mexico were frequented by 33-50 % of the pilots. Mexico was listed by 16-27 U.S. pilots. The number of countries flown through varied as a function of the flight plan. We did not have access to that information but relied on the information listed on each pilot's copy of the interview materials.

4. Which countries' airports have you landed at in the past three (3) months?

As shown in Table 2, in the three months preceding the interviews, the pilots landed their aircraft in 47 different countries or regions. Between 16-27 pilots reported landing in Mexico in the three months preceding the interviews.

Table 1. Countries Flown Through by U.S. Pilots in the Three Months Preceding the Interview.

Number of Pilots	Countries Flown Through
1-5	Argentina, Aruba, Antilles, Belgium, Belize, Bermuda, Bolivia, Cambodia, Chile, Columbia, Costa Rica, Crete, Cypress, Denmark, Ecuador, El Salvador, Fiji, Grand Cayman, Greece, Greenland, Guatemala, Haiti, Honduras, Iceland, Iraq, Israel, Jamaica, Kuwait, Laos, Luxembourg, Mongolia, The Netherlands, New Zealand, Nicaragua, Panama, Peru, Poland, Puerto Rico, Republic of the Philippines, Scotland, South Korea, Spain, St. Martin, Switzerland, Tahiti, Thailand, Trinidad, Turkey, Vietnam, United Arab Emirates
6-10	Brazil, China, Dominican Republic, Ireland, Italy, Japan, Russia, Venezuela
11-15	Cuba, France, Germany
16-24	Canada, England, Mexico

5. How many international flights have you made in the past 30 days?

In the 30 days preceding the interviews, 83% of the pilots flew one or more international flights for a total of 253 flights (mean = 5.27 S.D. = 6.41).

6. Where did you fly to in the past 30 days?

One pilot reported making 35 flights, including multiple flights to Costa Rica, Guatemala, and Venezuela. As shown in Table 3, the pilots had diverse flight experiences.

7. What is the first (primary) language that you learned to speak?

All U.S. pilots listed English as their first language.

8. What is the first language you learned to speak fluently?

All U.S. pilots listed English as their first language.

9. What is the language that you speak most frequently when at home?

All U.S. pilots listed English as the language spoken most frequently at home.

10. How old were you when you learned to speak the English language?

All U.S. pilots selected "As a preschooler (under the age of 6)."

11. Where did you learn the English language?

All of the U.S. pilots selected "It was taught informally in the home."

12. Do you speak English as a second language? (Not applicable to U.S. pilots)

13. Other than English, what languages do you speak or understand that are broadcast over your communications equipment?

Table 2. Countries' Airports Landed at by U.S. Pilots in the Three Months Preceding the Interview.

Number of Pilots	Countries' Airports
1-5	Argentina, Aruba, Australia, Belgium, Belize, Bermuda, Columbia, Cuba, Curacao, Dominican Republic, Ecuador, England, Guatemala, Ireland, Israel, Italy, Jamaica, Kuwait, Liberia, Nicaragua, Panama, Peru, Puerto Rico, Republic of China, South Korea, St. Lucia, St. Martin, Switzerland, Tahiti, Tanzania, Thailand, The Netherlands, United Arab Emirates, Venezuela, Vietnam
6-10	Brazil, Canada, Chile, Costa Rica, France, Germany, Japan
11-15	China, United Kingdom
16-27	Mexico

Table 3. Cities/Countries Flown to by U.S. Pilots in the 30 Days Preceding the Interview.

Number of Pilots	Cities/Countries
1	Amsterdam, Argentina, Aruba, Beijing, Belgium, Bogota, Brazil, Buenos Aires, Caracas, Curacao, England, Guatemala, Guatemala City, Guayaquil, Hawaii, Ireland, Jamaica, Kingston, Liberia, Limbunya, Manchester, Montego Bay, Monterrey, Narita, The Netherlands, Osaka, Peru, Puerto Rico, Punta Cana, Guayaquil, Quito, Rio de Janeiro, Saigon, San Jose, Santiago, Shannon, St. Lucia, St. Martin, Switzerland, Tel Aviv, Thailand, Toronto, Zurich
2	Dominican Republic, Israel, Italy, Mexico City, Panama, Paris, Shanghai, Tokyo
3	Cancún, Chile, China, Ecuador, France, Frankfurt, Hong Kong, Mexico, Santiago, Sao Paulo
4	Germany, United Kingdom
5	Costa Rica, Japan
6	London

The distribution of the 48 U.S. pilots' responses is presented in Table 4. Approximately 60% of the U.S. pilots reported they neither spoke nor understood languages other than English. For the remaining U.S. pilots, many indicated that they spoke/understood some French, Spanish, or both. In addition to Spanish, one pilot also spoke/understood German, and one spoke/understood Spanish, French, and Portuguese.

14. When communicating with controllers in English, would you prefer to hear or read their messages?

Of the 48 U.S. pilots who participated in the interviews, 33% preferred to hear ATC messages, 54% preferred to read them, and 13% had no preference. The distribution of their response selections is presented in Table 5.

The pilots' written responses are italicized. In some cases, their responses were changed from short phrases/clauses to complete sentences without a loss or change in their meaning.

Strongly Prefer or Prefer to Hear Messages From ATC

The pilots who indicated a preference for hearing ATC messages also had several themes in their responses that included Efficiency, Situational Awareness, and Familiarity. There is no doubt that

> Spoken communication would be more efficient — easier and faster communication. Speed of interchange of information. Information is rapidly conveyed; it can be questioned and clarified quickly. Orally, I can immediately get clarification.

Hearing ATC communications provides

> More situational awareness. I need to know what clearances they are giving in English when they give them in their native language. Speaking is faster and I can listen to the inflection and cadence in speech.

Another benefit of hearing ATC speak in English for U.S. pilots includes,

> It's what I'm used to. It's my native language, I'm familiar with the language, and I can do other tasks while listening — mostly based on familiarity.

Several pilots also noted some disadvantages with reading ATC messages. In particular,

> I've never had written ATC messages in flight, but other writings from Spanish to English have been very difficult to understand, and reading messages is a "heads down" activity not suitable for many phases of flight — assume pilot response is also written. Reading requires too much "heads down" time. Cruise is OK, approach and departure definitely not.

However, one pilot did note that,

> Some people/controllers speak too fast!

Strongly Prefer or Prefer to Read Messages From ATC

For pilots who preferred to read ATC messages, their responses fell into three themes: Accents/Pronunciation, Equipment/Message Reception, and Benefits. Specifically pilots wrote,

> Speaking English with a controller, whose native

Table 4. Languages Spoken or Understood by U.S. Pilots.

Language	Number of Pilots	Percent
French	1	2.1
French, Spanish, and Portuguese	1	2.1
Some French	1	2.1
Some French and Spanish	2	4.2
Some French, Spanish, and Portuguese	1	2.1
Spanish	6	12.5
Some Spanish	5	10.4
Some Spanish and German	1	2.1
None Fluently - only small phrases	1	2.1
None	29	60.4

Table 5. U.S. Pilot Modality Preferences to Receive ATC Messages.

Modality Preferences	Number of Pilots	Percent
Strongly Prefer to Hear	6	12.5
Prefer to Hear	10	20.8
No Preference	6	12.5
Prefer to Read	15	31.3
Strongly Prefer to Read	11	22.9

language is not English, coupled with poor radios, can lead to miscommunication. The written word is easier to refer to than the spoken word with less chance of misinterpretation. Speaking English as a second language can be very hard to understand especially when English is spoken rapidly and with an accent. Text messages eliminate accents.

Accents and speech rates make comprehension difficult. It is easier to comprehend written instructions than through heavily accented English. Reading would allow U.S. to clear up any confusion due to accent. Hearing is fine but with differences in pronunciation being able to read a message could be quite helpful.

Furthermore,

When talking to some foreign controllers, their English is so bad, or radios are so scratchy, that you are simply listening for what you think they are going to tell you. Also, a combination of poor radio transmissions and poor microphone/speaking techniques make understanding difficult, particularly in South America. Reading eliminates any reception errors. Radio frequently requires repeating.

Finally, the benefits of controller/pilot datalinked communications (CPDLC) were expressed by a pilot experienced with CPDLC and who strongly prefers to read messages from ATC.

I prefer datalink written ATC messages. Utilizing CPDLC would eliminate [mostly] accent-related communication problems and keep my understanding [e.g., situational awareness] at its best. I believe it minimizes hearback/readback problems significantly. There is less likelihood of a hearback/readback error with printed communications such as CPDLC. There is no confusion regarding intent. Much fewer errors when read. No mistakes. No questions. You have a hard copy of information — more time involved, though. With written text, you lessen the chance for readback error or misunderstanding. I think reading the English language would prevent any misunderstanding or the possibility of not getting a clearance. Messages in text format are clear and more direct. Clearances can be visually confirmed. There is less chance for errors, less ambiguity, and a minimum chance of misunderstanding.

No Preference

Among the pilots who had selected "No Preference," one had not had an opportunity to use CPDLC, while the other stated that each mode has benefits. Specifically,

High altitude [cruise] would prefer to read, but at the lower altitudes or during climb or descent, I prefer voice communications. When working in the U.S. or U.K., it is easier to use voice communications. In other countries where English is not the language, I prefer written communications. It can be clearer. It is easier to correct a misunderstanding via hearing a message. It is quicker to correct information via radio than written message.

15. When flying into a country where you do not speak the language, would you want a cockpit crewmember who could speak the language communicating with ATC?

Yes = 12 No = 28 At times = 8

"Yes" Response Selected

Twenty-five percent of the pilots said they would like to have a crewmember speak the language with ATC. Their reasons centered on understanding.

Other aircraft are speaking the language; we don't know their information unless everyone is speaking English. A crewmember who is proficient in the language always expedites understanding. In case there is any miscommunication, they could resort to the native language. It would help, but there is still a possibility of being "left out of the loop" and the interpreter not sharing information. It could result in less communication errors and less confusion. It would be helpful for immediate clarifications and situational awareness, but it is not essential.

"No" Response Selected

The majority of the pilots (58.3%) said no and their answers centered on Crew Resource Management/Situational Awareness (CRM/SA), Aviation English, and Pilot in Command. Clearly, CRM/SA was the dominant response. Specifically,

I have experienced this, and other crewmembers cannot verify the communications. It takes the English-speaking crewmembers "out of the loop." I believe that both crewmembers should be able to hear and speak the same clearance message. Otherwise, there is no backup. Having someone interpret all conversations in another language would hamper cockpit operations. You want to make the operation simple, not more complex. I would have to wait for a translation. Only one person in the cockpit knows what is going on. Meaning can be lost in translation, leaving no backup on communication errors. In an emergency, there may not be time for translation, if there is a proper translation from one language to another. I don't need or want a "translator" — I want ATC to communicate in their best English and I'll try my best to understand. That way, two of us are in the loop verifying the instructions. I would demand all communications be in English so all crewmembers understand all clearances.

"At Times" Response

The remaining pilots (16.6%) took a middle-of-the-road approach, answering with maybe.

Not exclusively — I would want all crewmembers to hear ATC instructions. It would be nice but not necessary, and there is no requirement. Also, it is not practical since we go to many different countries. What we mostly need is a set of ears and a brain without sleep deprivation. I would not want it as the sole means of communication, because other crewmembers would have no ability to verify the accuracy of ATC transmissions. It would be helpful to clear up misunderstanding to speak a foreign tongue, especially in abnormal situations.

16. When responding to controllers in English, would you prefer to speak or type your messages?

As shown in Table 6, approximately 71% preferred to respond to ATC messages by voice, 25% preferred to type them, and 4% had no preference.

Strongly Prefer or Prefer to Speak

Approximately 71% of the U.S. pilots preferred to speak their messages to ATC. Their responses were grouped into Speed and Efficiency of Oral Communication, Familiarity with Radio, and Increased Heads-down Time.

Speaking is not only much faster, easier, and efficient but also less time consuming and it takes less effort. It is easier to correct a misunderstanding via hearing a message and quicker to correct information via radio than a written message. It is also easy to make non-standard requests. Speaking is faster, and I can listen to the inflection and cadence in speech. It is easier and quicker for me to talk than type. There is less cockpit distraction.

Other reasons these pilots preferred to speak included

> It's what I'm used to. Because English is my native language it's easier for me, but typing would be a second option, and, as with anything, you get used to the change. The ability to type a message would be quite useful if I have difficulty communicating or understanding verbally. However, typing also can have errors, especially the typing setups in aircraft. I've never had written ATC messages in flight; other messages from Spanish to English have been very difficult to understand. Orally, I can immediately get clarification. Speaking is much quicker than typing, unless I had a menu of responses to choose from, such as a "hand-on" single movement acknowledgment.

Another common theme was heads-down time.

> I am against an increase in "heads-down" time in aviation. Typing will cause "heads-down" and a lack of situational awareness. Also, poor typing skills, coupled with "heads-down," redirect the pilot's focus away from aircraft control, and I don't want to be heads-down at low altitudes. I don't have time to type, and typing is too time-consuming. Typing takes too long to send and receive messages and removes the pilot from the "flying" while it is being done.

Strongly Prefer or Prefer to Type

U.S. pilots who preferred to type focused on the benefits of written communication. In particular,

> Experience with CPDLC has impressed me strongly. I believe it minimizes hearback/readback problems significantly. Written communication greatly reduces confusion. For non-English controllers, data-link would be easier for them to understand. Utilizing CPDLC would be a step in eliminating language translation errors. Written communications eliminates errors and cuts out miscommunication. There are fewer errors, and it frees up cockpit voice for inter-crew communications.

No Preference

The two pilots who expressed no preference did add a comment:

> High altitude [cruise] prefer to read, [but] lower altitude or during climb or descent, prefer voice communications.

Table 6. Pilot Modality Preferences When Responding to ATC Messages.

Modality Preferences	Number of Pilots	Percent
Strongly Prefer to Speak	15	31.3
Prefer to Speak	19	39.6
No Preference	2	4.2
Prefer to Type	9	18.8
Strongly Prefer to Type	3	6.3

Table 7. Pilot Listening and Speaking Skill Evaluation.

Listening and Speaking Skills	Number of Pilots	Percent
My listening skills are much stronger than my speaking skills.	0	0.0
My listening skills are stronger than my speaking skills.	2	4.2
My listening skills are equal to my speaking skills.	38	79.2
My speaking skills are stronger than my listening skills.	7	14.6
My speaking skills are much stronger than my listening skills.	1	2.1

Table 7. Pilot Listening and Speaking Skill Evaluation.

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My speaking skills are stronger than my listening skills.	7	14.6
My speaking skills are much stronger than my listening skills.	1	2.1

17. How would you describe your English language listening and speaking skills?

As shown in Table 7, approximately 79% of the pilots reported that their listening and speaking skills were equivalent. Almost 15% of the pilots reported that their speaking skills were stronger than their listening skills. Approximately 6% was divided between stronger listening skills and much stronger speaking skills.

My Listening Skills are Stronger or Equal to My Speaking Skills

Among pilots who reported their listening skills are stronger or equal to their speaking skills, four provided the following comments.

> Sometimes I don't really listen to hear, but listen to reply. My listening skills are somewhat degraded in foreign environments. I mostly have problems with the sound and clarity of transmissions and some being clipped. We are trained to listen intently and speak clearly and succinctly.

My Speaking Skills Are Stronger or Much Stronger Than My Listening Skills

There were four pilots who provided comments in support of their speaking skills being stronger than their listening skills. In particular,

> Human factors teach us that we generally speak better than we "hear," i.e., we listen to hear what we expect, not what was actually spoken. Accents and poor broadcast sound quality can make understanding difficult. I can clearly communicate my ideas, but sometimes what I hear was not the intended message. I am very experienced speaking, but listening also includes variables in pronunciation, accent, terminology, transmission quality, background noise, and workload.

Section 2: General/Pre-Flight Preparation

18. What do you do to familiarize yourself for international flights as compared with domestic flights?

Six pilots reported their preparation for international flights was the same as domestic. The oral and written responses for the remaining 42 pilots fell within the following major categories: Communication, Crew Experience, Procedures, Routing Information, and Weather Information. The pilots' oral and written responses were compiled, edited, and presented as a "Super Pilot." A "super pilot" is a construct representing the possibility of a single pilot having all of the international flight experiences of all 48 U.S. pilots within a small time window.

Communication

> To prepare for communication prior to entering foreign airspace, I'll review the charts for the airspace through which I will be flying, focusing on Flight Information Regions (FIRs), ball notes, etc. I will highlight at least the fixes that are close to the airport that I might be expected to have to read back in a clearance. I'll have the chart in front of me so that when I hear the fix name, I can glance down and see which one it might be. I'll review the usual routes with emphasis on NAVAID[5] names so that I'll have an idea of what the NAVAID names are in plain English. I'll try to familiarize myself with the names of all the places where I'm going, so if I get a clearance for some place that's not what I'm expecting, that I may ask for additional information or make sure that both of us are in agreement on the route that ATC wants me to fly.
>
> I speak more with my first officer about the threats we may encounter, which for me is language. So, I'm planning ahead, especially with language barrier problems, by trying to anticipate what the controller will say. I'll study the departure, arrivals, and approaches beforehand so that I might "pick up" on some broken English instructions that are different from the clearance. Sometimes I'll hear something and I ask, "What did he say?" So, I'm thinking, "What phrase might I hear?" That way, when it's transmitted to me, that hopefully it's the one I've selected. Doing so might make it easier to understand.
>
> So, I'll try to prepare for any clearances or something I expect to have issues with when I get to somewhere where they're not going to be native English-speaking controllers. I try to learn how agencies might sound on the radio. I have a little bit of heads-up, so I just like to put my head into what I might be hearing. I look at routings and waypoint names and try to imagine how it might sound if a Brazilian, or Frenchman, or other non-native English-speaking controller pronounced the name in English.

[5] NAVAID is short for navigational aid. It is any visual or electronic device which provides point-to-point guidance information or position data to aircraft in flight.

I'll try to study all the arrival names and be familiar with them, because if I'm anticipating a particular STAR and then some broken-English clearance guy[6] gives me something else and I'm going, "What did he say?" at least I have them pulled up, and I'm familiar with some of the names. Same thing on departure — after take-off they'll clear me direct to somewhere, and if I've never seen that name before, I'm usually going, "What did he say?" or "What was that?" I'm going to have to spell it, and that takes time. What I'm doing is looking at the points along my departure after I get my clearance and seeing what he might be clearing me to down the road, or anticipating something that he might give me so that I have a clue what he's trying to say. Just making sure that I am looking at all the points that I'm supposed to be passing and hearing what he has to say clearly.

Crew Experience

I'll review all the fixes just so I can anticipate clearances from the controllers. However, experienced crewmembers know what controllers are likely to assign. I pull-up the other crewmembers that I'm flying with to find out two things: (1) my familiarity with them, their strengths, and weaknesses; and (2) their familiarity with where we're going. If it's my first time, it's a great thing to have somebody that's been there multiple times because you can read a procedure so many times in the written, but if somebody can explain it to you, it seems to be much more helpful from the standpoint of understanding of what's truly going to happen. So, I talk to the pilots I fly with — who tend to fly the same routes over and over again — and I'll ask them what I should anticipate as far as clearances are concerned, or with routing. Most of the first officers on this airplane bring lots of different kinds of experience. Some of them have flown militarily in some of these diversion airports we're talking about, and they can tell you exactly what it's like. So, you need to make use of those resources. Just talking to other pilots, to guys that have been there before if you haven't been there, that I can speak with if I need help or just to tell me what to look out for is probably the best thing. So, I cover myself that way.

Procedures

I'll study oceanic and foreign procedures that are applicable in foreign airspaces that may differ from U.S. procedures. I review standardized terminology used at each airport for common procedures. Just because it's an ICAO standard doesn't mean that all this is the same as what we do in the U.S., though. After I leave the U.S., I really need to know what's there to make sure that I'm not getting sent to some other place or if they do descend me below an altitude, then I can ask why. Make sure I'm on the same line or someplace where I have some altitude or clearance information available. I'll take a look at the primary destination airfield in particular. I look at our specific airport page, at what to expect, that I may catch it the first time around without a repeat, so I try to see what they're expecting from me on a radio call, and then what time frame and who I'm supposed to be calling, and which frequency sequences they are, so that there's less confusion in the pre-flight phase of the cockpit setup.

Routing Information

Preparation is mostly navigational issues for me, and I prepare leaving the U.S. even before the flight leaves here. I take the Jeppesen publications as my initial starting point for learning about the area we're going into. I look for anything that's different than what I'm used to, just to make sure. Look at the routes, especially our South America charts, because they are peculiar in how they're constructed, at least to me. And, of course, I look at all the charts that would familiarize me with the terrain considerations. I mark up my charts to note FIR boundaries, highlight little boxes of information so they do not become a surprise. I try to highlight the routes that we're going to be using. I look over the SIDS[7] and STARS[8] at the destination, airport fixes, crossing altitudes, transition altitude, taxi route, gate location, and terrain. I look over those things just to wake me up on possibilities. I'll do that whenever I fly, but I do it especially if I'm going someplace different. I'll hit it harder than I normally do.

I get on our company's computer system and pull up the routing that is expected to be flown on that day. I can look at the charts and fairly well know where I'm going so that I have some familiarity with not only the VOR[9] identifiers, but the intersections and stuff that you might not otherwise know at all. I'll look at the preferred routes and try to have the charts available for those routes to see if a lot of information has been put on the charts. Sometimes I can pull the whole thing up on the computer and then have a copy of it before I show up at the airport. I review the Flight Operations Manual (FOM), the flight manual (FM), and all appropriate charts and maps for the area that I'm flying into.

We look at the airway manual for [theater] guidance. I review the charts and approach plates much more carefully and am fully aware of all ball notes prior to departure. I look at all the [ball] notes on the charts and familiarize myself with all the fixes and all the arrivals and everything around the airport that we're going into. [Ball] notes are a big thing. I really rely on them. A ball note is a reference note Jeppesen puts next to a fix. Then, you look up that note in a separate section because it gives you more

[6] The person who provides clearance delivery.

[7] SID is short for Standard Instrument Departure. It is a preplanned instrument flight rule ATC departure procedure printed for pilot/controller use in graphic form to provide obstacle clearance and a transition from the terminal area to the appropriate en route structure.

[8] STAR is short for Standard Terminal Arrival. It is a preplanned instrument flight rule ATC arrival procedure published for pilot use in graphic and/or textual form. It provides a transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

[9] VOR is a ground-based electronic navigation aid transmitting very high frequency navigation signals, 360° in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. It periodically identifies itself by Morse code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots.

information. NOTAMS[10] are always a big factor. I look at the applicable NOTAMS and things that might affect me when airborne. In one particular country, it seems that their NOTAMS come up in the local language instead of English. We don't read nor speak that language. When they do, we need to get hold of a dispatcher and have him put a converter on it so we know what it is in English. I'll pay particular attention if there's anything new going into the flight or I mainly fly a routine flight. So, I'll look at it if there's new construction, outages, or anything like that, just so I won't be caught by surprise when we've all been up for 25 hrs.

I'll look over the green pages for the specific airports as to what's going to happen. I'll read country pages in Part II FM and review the actual airport that includes holding charts they're going to use, so it's not a complete surprise if they spring something on you. These pages provide us with specific navigational and operational issues to operate in those various countries. There are slight variations in each country, and it qualifies us in about two pages on each country. Once you start flying into the airport, you find a lot of local information [gouge][11] and a lot of things that you can expect in terms of arrivals that probably aren't listed in the manual or green pages. When I go into a place, I actually write down the frequencies going into and coming out, any of the routing, and things like that. I have gouge sheets that I've built up for doing that. They're a good first cut at preparing you to go into most of places that I've flown. I'll also ask other pilots for their personal gouge.

Weather Information

Domestic is easier because of the availability of electronic and printed media. By that, I mean you can wake up in the morning and see the Weather Channel on TV, read the headlines in the newspaper and the papers associated with the weather, and get kind of a general feel for it. I'll call dispatch to find out what the weather conditions are over the ocean.

International is more difficult. By that, I mean you may not be able to get a newspaper in the morning. I try to look at the Weather Channel internationally to see what the weather is and what it's going to be. You might be able get a weather channel, but you certainly don't know if it's Spanish, French, Italian, or another language. In other countries, you're at the mercy of whatever cable channels you have, or sometimes they have internet, sometimes they don't. It's country specific, so once you're out, you're trapped. So, you get kind of an idea, and then by the time you get to the airport, the planning process really comes down to the packet of information that's given you, and what access you might have to the computer. In some cases, you don't have any.

Thank goodness for the Internet. I'll go on the Internet and pull up the weather. AOPA has a weather site. The FAA has a weather site, and the company has a commercial provider that they use. I may look at general weather patterns, especially over the North Atlantic when it's a little bit more diverse. Near the equator, it takes a little bit more work to get to know what the weather and volcanic activity's going to be than domestic weather. I'll take a look at it because it might be out of the ordinary, mostly just weather that might be unfamiliar.

One of the biggest tools I use is the Weather Channel, because I want to know if there's a typhoon that's headed in the direction of any of those cities. And that gives me a real heads-up as to what I definitely can expect. Normal weather can be like it is anywhere else: You may have a good day, you may have a bad day. But if there's a typhoon on the way, then there's going to be a problem. On the route, I have to check for Bermuda because it's often closed for weather.

I'll review the weather information again because I need to really make sure what the weather is all along the route of flight ETOPS [Extended-Range Twin-Engine Operations].The ETOPS concept on the 400[12] is really going to help force people to do that. Pilots will be thinking more about, "All right, what's the weather?" instead of, "Well, we're not going there. We don't care."

I also experience difficulty understanding automated recorded weather due to heavy accents. I have to listen to it over and over and over again, trying to figure out exactly what is being said.

18a. List the sources of aviation information you use to prepare for international flights.

In answering Question 18, six pilots had no input, as they reported their preparation was the same. The responses from the remaining 42 pilots were extracted from the questionnaire and grouped into nine major sources of aviation information. As shown in Table 8, Applicable Company Charts and Plates, Jeppesen Charts, and Flight Plan information jointly accounted for 77.6% of the items listed.[13] Also important was Weather information, accounting for 10.3% of the items listed.

During the discussions, some pilots mentioned other crewmembers/pilots 14 times and security information

[10] NOTAM is short for Notice to Airmen. It contains information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

[11] A "gouge" is a collection of personal notes of a pilot that provides information about previous flights that serve as memory joggers.

[12] Reference to a particular aircraft series.

[13] Most pilots mentioned more than one type of aeronautical chart. The terminology for aeronautical charts included "charts" only, as well as enroute, terminal, approach, area, airport, navigation, high, low, normal, Japanese, oceanic, and crossing "charts"; SIDs, STARs; terrain maps; Part I and Part II maps/charts, ball notes, and company-supplied charts. "Jeppesen"/ "JEPP(S)"/"Jepp(s)," only as well as "Jeppesen"/ "JEPP(S)"/"Jepp(s)" charts; manuals; airport pages; maps; enroute, area, and terminal sections/charts; pubs; 10-7 pages; Part II. Jeppesen also includes, on some charts, the pronunciation of waypoints. Company manuals, electronic data, Web site, dispatch. 42 pilots mentioned one or more company source. Terminology included Operating manual (FM I, II), CPDLC, position reports, clearance, company documents/manuals/videos/Web sites/pages, (our) flight operations manual (FOM), flight manual, flight papers, company CBTs, international flight ops guide (IFOG), company materials, bulletins, (company) airport summary guide, (company) airway manual, airway manual for [theater] guidance, green sheets/pages, guides, [company] special pages, Unimatic computer/briefing guide, F4 messages, jet manuals, company training materials, [company] bulletin boards, newsletter, [company] 10-7 and 10-9 pages, [company] tip/gouge sheet; flight management system (FMS).

Table 8. Sources of Aviation Information Reviewed by U.S. Pilots in Preparation for International Flights.

Sources of Aviation Information	Frequency	Percent
Aeronautical Information Manual	2	1.2
Airway Manual	3	1.8
Applicable Company Charts and Plates	48	29.1
Dispatcher	5	3.0
Flight Plan	27	16.4
Guides	4	2.4
Internet	6	3.6
Jeppesen Charts	53	32.1
Weather Sources (Weather Channel, Internet Weather, Company)	17	10.3

Table 9. Anticipated Language Difficulties in Preparation for International Flights.

Pilot Anticipated Language Difficulties	Frequency	Percent
Controllers' Inability to Communicate in Plain Language	27	24.8
Controller Voice Quality and Speech Rate	10	9.2
Cultural Differences		
English Language Comprehension and Production (Differences in the Pronunciation of a Fix, Intersection, or Waypoint; Differences in the Pronunciation of Numbers; Expectancy can get you in Trouble)	34	31.2
Frequency Congestion	3	1.8
Multiple Languages on Frequency (Language-Induced Gaps in Situational Awareness; Native English-Speaking Countries)	18	16.5
Non-standard Terms for Standard Operations	14	12.8
Poor Radio Equipment, Coverage, Quality (Air-to-Air Communications)	3	2.7

six times (the number of times a particular source of security information is presented in parentheses). The sources of security information included AOPA (2), FAA (1), Company (2), and security advisories (1).

18b. What are some language difficulties you anticipate (or have experienced) when flying in international airspace?

The participants listed 109 examples of language-based difficulties that were compiled into eight major groupings. Many pilots expressed similar ideas, and their written responses were grouped into common themes. There was no discussion regarding Radio Frequency Congestion in a context other than in the category of Multiple Languages on Frequency. During the discussions, pilots also talked about cultural differences, although they did not list them as examples of language difficulties on their questionnaire.

As shown in Table 9, English Language Comprehension and Production and Controllers' Inability to Communicate in Plain Language accounted for 56% of the problems pilots anticipated. During the small focus group interview, oral responses were embellished and discussions expanded to include Cultural Differences. A summary of their remarks is presented alphabetically by the hypothetical super pilot.

Controllers' Inability to Communicate in Plain Language

> At times when you ask a basic question dealing with weather, runway conditions, or something that is not standard, the controllers cannot answer that question if it's not something that they would expect to parrot back. I just had a problem down in one country with the meaning of RVR. The controller had no idea that RVR was for runway visual range. So, it can create some major problems.

Interestingly, another pilot in a different aircraft, flying for a different company, also shared the same story to illustrate the problem.

One night, we were on the descent, and we had just been turned over to the approach controller at 18,000 feet. It was a clear perfect night. The airport is surrounded by mountains except for one entrance that is shaped like a horseshoe. As we were listening to check on, we heard another airplane that had gone around and was getting back in line. The first thing that we heard was the other airplane asking for the RVR. There was silence. Apparently the controller did not understand that the pilot was requesting the runway visual range, so there was silence.

We got vectored around and onto the approach. He clears us to Tower. We switch over to Tower and there's no answer, so we continue. We're at about 4,000 feet picking up the glide-slope, starting down. We go back to approach control and tell him we cannot contact Tower. He says nothing except to "contact tower." He doesn't understand.

We go back to Tower, still no answer. So, at about 1,000 feet, I asked the FO to contact ground and see if they'll give us a clearance. We know that the guy probably works all three or, in this case, at least the Tower and Ground. No answer on Ground, so we tried again and again. The visibility had dropped so we could only see halfway down the runway. At about 100 feet, we decided to go around instead of land. We were tight on fuel and were probably going to have to go to an alternate, but we went around. We had enough fuel to come around and try it again. We told the controller and came back up on Approach Control. We didn't get an answer right away, but then he goes, "Roger, contact Tower." We contact Tower; this time the guy answered, cleared us to land at minimum. So we break out — it's really dropping, we break out, land, and get off the runway about halfway down.

The next day, I asked the Ops person what was going on. He said if they don't understand, they don't answer. He told us that these guys have a script that they can read from. If you check in, they know to say this; if we're doing this, they know to say that; but if anything out of their realm happens, they are done. And rather than say anything, they just don't say anything at all.

I'm not sure their English is all that good. When I ask a question, some will just keep saying the same thing over and over again, louder and louder and louder. I still didn't understand what was being said and speaking louder didn't help. Part of the problem is the accent — I have difficultly understanding what is being said.

In one particular country, advertising is done with hot air balloons. Some of the hot air balloon trains may be 20 to 30 feet in length, held together with metal cables and some with strings. It's not uncommon for five or six people's balloons to be in the approach corridor. Because the controller doesn't know how to tell us about the balloons, they tell the pilots of their own country's registered airlines about the warning and have them relay it to us in English. The controllers would tell them what to tell us.

If you don't ask something that they expect you to ask — like reading from a script — they can be lost, so you have got to be insistent. If we can't accept a clearance because of weather routing, we need a different runway because of a maintenance issue, we need certain runways for certain take-off performance, or anything else, it stops the machine. ATC may not ever understand what we're trying to say, but they finally accept the fact that we're not going to go along with what the controller is telling us. They either get another controller on the frequency, or we come up with some other plan. And then half an hour later, we ask for the supervisor.

Like I said, as long as everything is standard, there's nothing unusual happening, and if you keep everything in ICAO verbiage, it's fine. The communication barriers will highlight themselves when there is some sort of emergency. The tone in our voice gets a little elevated, we start talking faster, and we start using a little bit of slang when you need information right away and you've got an airplane falling apart or doing something else, and the controller doesn't already respond. And then he usually will either not say anything or say "roger." So the responsibility is really on us when we go there, and that's why it's just kind of a more relaxed type of flying in the States. When I leave the States, I have to be aware that ATC might not be aware of everything that is going on in my situation, and they might not be as sharp with the English language as folks in the States. So, I just have to be aware of that and err on the side of safety.

Sometimes there's difficulty conveying our wishes due to a controller's comprehension skills. A big area where this is a big deal is weather. When there is a large thunderstorm between my airplane and the airport [with the] gunnery range at one side of it [and] lots of airplanes on the other side of it, [and I want to] get across to the controller that I cannot do what was just asked of me, I'll say, "Unable" and you can literally see a big question mark out there over his head. It is as though he is thinking, "What do you mean, unable? I gave you a command." Well, it's not the way we operate at our company. He can arrest me when we land if he wants.

I'm fortunate to be able to speak the languages of the countries that I fly to. It has been very helpful to me because I kind of understand the accent or the intonation of the controller's voice. Sometimes if we're not getting the word across to each other in English, I'll revert to the local language and talk to them. That leaves my crew out of the loop and that can create a danger. Although I understand what the controller is saying, I may not catch a mistake, or the crew might not catch my understanding of the transmission, because they don't know.

Controller Voice Quality and Speech Rate

And I have always said the accented, high-pitched voices are some of the hardest to understand. High-pitched voices are not transmitting clearly. Some controllers speak too fast and, if you ask them to repeat, they speak faster. So, when they try to speak English, they try to speak it very rapidly and with a bad accent, and it's sometimes tough to follow. When I take a newbie there I say, "This is what we're going to expect to hear." And then when he gets it, he goes, "Did he really say that?" I go, "Yeah."

Cultural Differences

In the States, the way that we, as a group of pilots, view the controllers is that they know who we are, they know where we are, and they're not going to give us an unsafe clearance. In some countries, it is just flip-flopped — that's how the controllers feel about us. There are a few places left where a captain is still the captain. They assume that we know where we are, what is underneath us, and that we're not going to accept an unsafe clearance. So if a captain is asking for something, then ATC thinks that you know what you are doing. By the same token, if he's giving you something that might put you in jeopardy, it's up to that captain to make sure that he knows and he can comply with that restriction. So, as soon as you get outside of the box of just being normal, that's when the communication/language barriers will start elevating themselves. ATC thinks you know exactly what you are doing. If you ask something, they're going to give it to you. They just assume you're going to be clear of mountains or that you're going to be clear [of] weather. If you ask for it, you must know what you're talking about. And they'll do it.

English Language Comprehension and Production

The English language spoken in some countries is very difficult for me to understand because of their deep accents. They may think that they're proficient in English because they speak fast, but they're speaking with an accent that I'm not used to; my ears are not tuned to that, and I'll often miss it. Also, the way I pronounce something isn't necessarily the way a foreign speaker pronounces it in English. Some controllers speak in dialects of broken English that make it difficult for me to make sense of what they are saying.

I rarely accept what I hear on an international clearance without clearing it across the cockpit before I retransmit on the radio because I usually miss one or two things. It might be a frequency number or something else. So, that cross-cockpit confirmation — "Is that what you heard?" — before you get back on the radio to verify your clearance, is very valuable.

While coming in for the arrival in one particular country, I didn't understand a single clearance I got, including the clearance to land. And I looked at the captain and said, "Is that a clearance to land?" and he goes, "Yeah." He had been doing that for two months straight and knew what to expect and when to expect it. He was able to hear and understand what was being said, because I couldn't.

I think it's the inflection, dialect, or just a heavy accent. For example, when I came out of one country, I had no trouble understanding the controllers; I thought they spoke at a nice rate, and they were real clear. And then when I came over another country, we asked one controller three times to repeat his message; we looked at each other, and neither of us really could figure out what he said to us.

Some areas are by far the most challenging when it comes to understanding what they're saying. ATC may know this because they gave us a sheet of paper telling us what the controller will be saying. Then we get in the airplane, and we're pushing back and getting our clearance. I don't know what was said at all. I assume that's why they gave us this sheet. So, you just go, "Roger" and press on, which is kind of eerie.

Differences in the Pronunciation of a Fix, Intersection, or Waypoint

Probably my biggest issue is the pronunciation of some waypoint names in foreign airspace seems to vary. So, I'll try and verify a specific waypoint, fix, or clearance with regards to a map or flight plan. When you hear a non-native English-speaking controller pronounce a fix, waypoint, or intersection, sometimes it doesn't sound like what you're anticipating the English pronunciation to sound like by looking at its spelling on a highlighted chart. I realize they're not going to use English words to name their waypoints in foreign airspace. Accent and emphasis variations can make words sound completely different, but sometimes their use of consonants and vowels in certain combinations make them all sound the same. So there might be a list of five waypoints in my route that could have been any one of the ones that they said I was just cleared direct to. I might need to have them phonetically spell it out for me before I can understand what they're saying. I think that in some countries' airspace, the waypoint enunciation is difficult to catch without phonetics.

Due to the accents and the speed that they're speaking, I personally have to ask them sometimes to repeat themselves more slowly or spell fixes phonetically to get the understanding correct. I have to make sure that all of us are hearing the same thing. I've had it happen where we're all listening, but can't decide what fix he's trying to give us. We've been up for 18 hours, so give us a break and spell it for us because we can't understand the pronunciation. All we're asking for is the spelling.

Again, because of the accent, we never really did come up with exactly what he was saying. We came up with a pretty good consensus of what we thought he meant, but I don't think any one of us was 100% certain what the clearance was.

As an example, there's a VOR spelled N-A-N-T-E-S. With a Spanish and Italian family background, I would have said "NANTES." Locally, the VOR is pronounced as "NOT." ATC can say "NOT" all day long and I can be looking at the chart and not make the connection between what ATC just said and what I'm reading on the chart. I'm expecting "NA," so the only way I'll pick up what was said is to have ATC spell the identifier phonetically. Then we all understand; we're all on the same page then. By using the phonetic spelling, or if I could read it on some kind of uplink, that would be the way the communication is best solved in my cockpit.

Differences in the Pronunciation of Numbers

Heavy accents are probably the most difficult thing because, even though you're actively listening and hearing, you quite often cannot understand what was said. Sometimes things as simple as hearing your call sign is difficult. You're listening for it, but you still can't

make out that that's what they said. The frequencies, the numbers are quite often difficult to discern, as are altitudes because of the numerical basis.

When flying outside the States, I find that my repetition early on saves confusion and scurrying like a mouse with the charts and plates later on. And the anticipation is they are going to clear you to something you haven't heard before. If I look at the flight plan and then look at the transition on the approach plate and just look at all of it, I might get an idea of what they are telling me. I tend to almost expect not to be able to comprehend an entire transmission the first time around. So I look at the flight plan — they could give that one, that one, that one, and at least by looking at the points along my flight, I load my mind with what I think those points might sound like.

And sometimes the best thing to do is have them spell it phonetically so I can find it. At times we sort of force the controllers into using the phonetic alphabet. They'll give us the name of a point or fix to fly direct to, and we may not understand them. We'll come back with the phonetic spelling, which we think is what they told us, and the phonetic spelling tends to be sort of the universal language. So we'll go through that and we usually can understand them.

Expectancy can Get You in Trouble

However, sometimes you're going to see something that is unfamiliar that you haven't seen before, and Murphy's Law all of a sudden kicks in. When I'm up in the cockpit and it's still dark and we haven't coasted in over the land yet, I try to just look at all the possibilities. They are going to clear you there instead of what you expect. You may hear what you expect to hear, but that's not what he said, and it's easy to fall into that trap when you are flying the same routes over and over. It's almost like in the movie "Groundhog Day." Nothing changes. It's always the same. He's always going to say direct [intersection A]. Then, one day, he's not going to say that, but I've already told the crew he's going tell us direct [intersection A] however, he tells us [intersection B]. And we're not going to hear it because we expect to hear [intersection A], and that is a huge trap.

I don't understand what the guy said, but I think I know what he said, because that's what he said yesterday, and that's what he said last week, and that's what he said the week before that. And they do tend to give you the same clearances to the same FIR values to the same fixes over and over again. It is a problem for the pilot-not-flying who hasn't been there before, because he has no idea what the controller said. Then we, as captains, say, "Well, this is what he told us," and, of course, he nods his head and punches in the button and away we go. But it is a threat that I hope that we all understand could be a real huge problem.

If I'm lucky enough to be following another aircraft that I know is going to be getting similar clearances, I try to listen to what other aircraft are getting ahead of me, to have an idea of what to expect to hear. And that way, if I get the same thing it's like, "OK, I've verified that that's the similar clearance." Otherwise, that's maybe a 50 50 shot that that's going to happen. It really is a matter of asking for the clearance, and when I request it a second time, I usually try to make my English as well-pronounced and slow as I can to indicate to them that it was a communication barrier, and not a radio problem is why I'm asking for the repeat.

Multiple Languages on Frequency

When ATC is communicating with pilots in their native language and we need to communicate with ATC, we are clueless as to the context of what's going on in any of those exchanges. So, getting a word in edgewise, knowing that it's my turn to speak when ATC said something, and knowing that it was actually me that he was giving the clearance to. Since we can't understand their language, we may cut in right at the end of somebody that just asked a question, is waiting for the clearance readback, or whatever. When we break in, we're trying to base it on the cadence of the conversation. In some countries, the cadence doesn't seem to vary enough to give us enough subtle clues to tell if an exchange is over. So, we do interrupt and end up finding out by not getting a response until we've called a second or third time.

Language-Induced Gaps in Situational Awareness

I have difficulty in situational awareness environments where the controllers and pilots are speaking in their native language, and I'm not sure what they're saying or where they are, or what clearances the airplanes surrounding me might be getting. Consequently, it takes a lot more effort to try to listen to the clearances that are being given to the other aircraft out there flying through non-native English-speaking countries. I find myself not being able to look at other stuff around the cockpit because I've focused so much of my attention on trying to hear what's being said out there.

Situational awareness diminishes when the controller speaks to others in the native tongue and whoever he's talking to is in your vicinity, and you don't know what he's saying. It's between the two of them that they got it right with regard to you, because you're not in the loop anymore like you were if you understood them. I think that's a bad thing. Using native language with local carriers when you're on the radio — that's a real challenge. You hear the controller giving a clearance or an altitude change and they're using their native language, and you don't understand what they're talking about. And it actually affects you because you're in the same airspace with that other carrier.

And then the other thing that bothers me is that if you can't understand the language where you're at, you can't keep track of the other airplanes on the radio as well, so you don't know what's happening around you nearly as well as you usually do. Your situational awareness is greatly reduced because we talk about clearing on the radios for the count — making sure how many people are in front of you, how many people are behind you, who is doing what. You can't do that if you don't understand the language.

When you're on the ground, you don't know necessarily what runway they were cleared to land on

or what they are doing. You don't know where those guys are taxiing to. So, again, you can be as diligent as you want. You can study as much as you want to; it doesn't make any difference. You don't know what that clearance was to that other pilot in that other airplane so, that reduces situational awareness, safety – or both in my opinion —but the other thing to add was phraseology.

I was making a conscious effort to try to hear the controllers talking to the other aircraft, and in spite of my best efforts, about all I could figure out was you hear the airline call sign and you might be able to pick out an altitude that they were flying, but if you try to listen to a clearance after about the first or second or third word of a very long sentence or clearance, you lose all that was going on. Your situational awareness of the other aircraft around you is terrible because you cannot understand. And let's say an aircraft is being controlled in the native language. You will hear the controller speaking to their local aircraft in the local language. You lose the ability to have the situational awareness of where he is and what he's doing because it's in the local language, and I don't speak it at the rate the information is being conveyed.

Native English-Speaking Countries

Accents are probably the biggest impediment in understanding communication. It's the English-speaking countries that I have a more difficult time with because the accents are so thick. When you go there, I think they expect you to understand English, and we expect to understand them. But their accent is so heavy — it is so far from English in my opinion — we often have a lot of trouble. We both speak English, but it's readily thought that we understand each other because we speak the same language when the accent is actually making communication difficult. I just went with a guy over to London last week. He hadn't been there in a long time, he was a pilot-not-flying, and he was having a hard time understanding the British controllers because they were speaking English. We don't speak English — we speak American, so it's not the same language.

Non-Standard Terms for Standard Operations

Different phraseology is used in different countries, and it seems like everybody has their own little terms. There are some unique phrases that you hear sometimes that you might not have heard before unless you've talked with people. In some countries, the controllers say, "How many miles to run?" Well, if you're downwind and you were going to go 20 miles on downwind and 10 miles on base and 20 miles on final, they'll add all that up and say, "You're 50 miles to run, so you can plan your descent rate to do a continuous."

In the States, it's "taxi into position and hold," in another country it's "line up and wait." Still elsewhere, "on the same position" and "hold here" means "line up and wait." You have to pay attention to anticipate exactly what they are saying and what they want you to do. When you go to France, and if you're cleared on the approach or cleared to intercept, you're also cleared on the glide slope. In England, they say you're cleared on the glide, which is a little different than what you might expect to hear. If you don't understand it, then you ask for them to clarify. It always helps to talk to somebody who's been there before.

Another example is "cleared direct." In the States, it means from your present position direct to a known fix. Direct in the international ICAO arena means pretty much flight plan route, so there is some confusion potentially there. When you fly into Kingston's airspace, they'll say cleared from the FIR entry point to FIR exit point, and they mean a straight line. You need to clarify because a cleared direct could mean cleared direct on your route of flight and not the direct that we use in the U.S. In fact, in the Cali incident, the first officer [FO] asked, "Understand, we're cleared present position direct to this point?" and the controller said "Yeah," but that's not what he meant at all. If you get off ATC language, there's going to be silence. If you, as a pilot, have a question, say, "Hey, is this what you mean about that?" They're going be like, "Huh? What did he say?" That FO knew to ask that question and he did ask that question and he got the wrong answer. So that was a communication error right there.

Poor Radio Equipment

Transmission quality is generally inferior in the third world as compared with U.S. domestic or European operations. Many times the radio sounds as though the person on the other end is speaking into a 55-gallon drum. Echoing can add to comprehension problems.

Air-to-Air Communications

Our weather and turbulence information is highly limited across the Atlantic or equator. We just know that we're probably going to get a lousy ride. If it weren't for the planes talking to each other on the common frequency for air-to-air communications, we wouldn't know that. That's how we actually find out how the rides are, because ATC won't tell us. They may know, but they're not talking to us and we're not hearing it. So, the best thing we can do when we go back and forth is to ask a northbound passing southbound, "How's it in the Gulf?" and everything else, and they give us the ride report and we tell them how it is in South America coming up, or vice-versa. It's the same going eastbound and westbound. I'd say the same thing in Japan on the tracks out there. The first one who gets the ride report passes it back so you know where it is. On the tracks, when somebody gets something, they let everybody else know. So the information is 2 to 3 hours old in the worst case, but they've got the best weather information available.

19. Air traffic control procedures vary from country to country. What effect has the difference in ATC procedural complexities had on your flight experiences?

Table 10. Effect of Different ATC Procedural Complexities on Pilot Flight Experiences.

Effect of Different ATC Procedural Complexities	Number of Pilots	Percent
Very Positive	0	
Positive	5	10.42
Neutral	19	39.58
Negative	24	50.00
Very Negative	0	

Table 10 shows only a little more than 10% of the pilots reported a positive effect, about 40% reported a neutral effect, and 50% reported a negative effect of the differences in ATC procedural complexities concerning their flight experiences. Once again, each pilot's oral response was transcribed and then grouped together with the other pilots' inputs according to common themes and response type (positive, neutral, or negative).

Positive Explanation

It's Allowed Me to Develop My Piloting Skills

It's a learning experience for me. It causes me to raise my situational awareness. I become more aware, more definitive, and more deliberate in those situations. I'm learning from each flight as I go to different parts of the world. I can see a change in procedures as one more notch in my belt because I learned how to do it here as well as over there. The positive part is the knowledge that I've gained has allowed me to grow as a professional pilot.

It's Better Now Than It Was 20 Years Ago

There are two different ways to fly; we have the way to fly in the U.S., and we have the way to fly outside the U.S. Aviation is a dynamic environment. Things change from time to time and point to point. In the U.S., we wait for controllers to tell us to do something, we react and we do it. We can't fly that way in the other countries. When I first started flying to other countries about 20 years ago, it was horrible. These days, I have a lot more confidence in working with non-native English-speaking controllers. I can really understand what they're talking to me about and what they want me to do. Now they're more runway-specific, so it's gotten a lot better. Still, some countries are relatively new to this world of international travel. I can see on every trip how much better they are getting, but they are still vague in how they handle clearances, clearances to altitudes, headings, and so on.

Other Countries Collaborate More Fully With Pilots

There are parts of the world where I tell them what I want to do, but I tell them nicely in the form of a request. I can say, "Can I go here?" or "I'd like to start down now." And they'll say, "Oh, OK, you're cleared." So, if we tell them what we want to do, it makes their job easier. It makes my job easy, too, because I don't have to wait for them to do something. The next thing I know is that I am 3,000 or 4,000 feet higher than I want to be, so I'll ask, "Hey, can I start down now?" They'll say, "Oh yeah, you're cleared." Pretty soon they'll say, "You're cleared 1 Approach." I ask, "Can I have the other approach?" because that's the one I built, and they'll say, "Yeah, go to the other."

Neutral Explanation

It Depends on the Pilot's Flight Experience

I put "neutral" just because of my experience. If it is my normal everyday procedures, I don't think it's that much of a problem procedure-wise. I feel the procedures are spelled out well, but it's just sometimes how they are implemented or how the procedures are communicated. Since I know that we are flying to different places and they have their own way of doing business, we have to adapt to their ways, as long as it's not unsafe. We have to pay attention a little bit more, and it's not a continuous flow from the way that we do things to the way that they do things and so, there's a little block in the road, but you just have to kind of adapt. Luckily, I know what is going to take place, and I know where they are coming from. I know what they are going to ask. If you have been down there as much as we have, you know what's coming, you know how to plan for it, and it's not an issue.

If it is a new captain or crew who has never been there, they don't know what to expect. There are some differences. They have a lot more problems. For example, in some countries with non-radar airspace, if you want to change altitude, it takes awhile for them to get back to you on that. They have to coordinate. They have to get their measuring devices and figure out where everybody is. And, by the time you know if you wanted to descend for weather or turbulence, it may be 10 minutes before they can get your clearance down. The non-radar approaches obviously also are a concern. TCAS gives us an advantage over the controller who's working approach and ground clearance and does not have radar. They don't know where those airplanes are. They're doing their best, and they do a pretty good job, but for the most part we're looking at TCAS, and we're very aware of where other aircraft are. We do a lot for ourselves. But after a few flights, it's just operations as normal, and they get a feel for it.

Negative Explanation

Aircraft Equipage

Be careful about the way the system on Airbus works because it's designed for European airspace. I typically will be cleared for an arrival tied to an approach without further clearance, in certain airspaces. And that's the way they built the design of that flight management system (FMS). And so I need to, in this

airspace, make sure that I untie the approach from the arrival, because I never get an approach clearance tied to an arrival clearance. And so, not being aware that that's what we just got cleared for, with the terminology they're using in different airspaces, it can be confusing to an aircrew. And it tends to vary from airspace to airspace. A given airfield, that's the way their approach control works — they clear us, as well as other aircraft, for the whole shooting match. The approach will be sequenced similar to what it is domestically.

Altitudes and Altitude Restrictions

In some countries, the controllers give me a nice, slow, steady descent or climb. Everybody's doing the same thing. In other countries, the controllers will dump me down in terms of altitude. I am cleared down to an altitude, and then they expect me to almost instantly descend my aircraft 20,000 feet.

Some countries have very specific rules on leaving our altitudes, and when I'm cleared to an altitude, I will always announce leaving an altitude and arriving at the new altitude, which I don't necessarily have to do domestically. Also, if I am cleared for an arrival or a departure that has altitude restrictions, I am always expected to make those. When I am on a standard instrument departure [SID], I have to hit each of the altitudes along the way. It isn't that way in different parts of the world. So unless I catch the differences in the region section of the flight operations manual, it becomes very problematical that I'm going to get it right.

Whereas, here in the United States, if I am cleared on a departure to a high altitude, then in general, the intermediate altitudes are waived. There again, from the previous question, I read the regional sections in our flight operations manual, and it spells out those changes pretty clearly. So you have to be familiar with those.

Also overseas, if you get cleared to climb to FL330 and you're down at low altitude, you still have to make your restrictions in between. In the States, it generally means unrestricted. Those kind of procedural changes introduce the possibility of error and uncertainty. Do they mean an unrestricted climb or not?

Differences in Altimetry Settings[14]

There are differences in altimeter settings that vary from country to country. Some report inches of mercury [Hg] versus millibars [mb] versus hectopascal [hPa]. I think these varieties affect significantly what you hear and say. It really puts a premium on experience and preparation. The altimetry setting is so different in every region that we fly that I really have to brief all my crewmembers and give specific duties, whereas in domestic U.S. airspace, I really wouldn't do that. I can pretty much automatically fly from here to Chicago or Chicago to San Francisco, but the lack of standardization from domestic ATC procedures to international is something that I have to really review because my habit patterns are based on the altimetry over here. In the U.S., we all know that the flight level never changes from inches of mercury to anything else.

Well, it's different in Europe. When I go there, they're so much lower, and I really have to designate somebody to pay attention to that. "Don't let us overspeed the flaps. Don't let us bust the altimeter." I take care of the transition altitude and the flight level, so it's a whole different operation. The chance of errors goes way up. So, our situational awareness has to be high, and the other thing is that we're always on the backside of the clock, so fatigue plays a factor. In a very high workload and kind of a complex situation, it's usually when we're the most tired, and that can be dangerous.

Communication Procedures

Differential Familiarity

Our FOM is broken down into different regions — Europe, the Pacific, and so on — providing information on how each state operates. Most of what I need to refresh myself on can be found on the green and white pages, the approach plates, and things like that. I know some information is important, and some only becomes important if "x" happens. And there's just a lot of material depending on where you're going that day and what's going on. It is all there in the reading.

The novice

The first time pilots leave the U.S. to fly into a different country, or go into an area that they're not used to or haven't been to in awhile, there will be problems. There are always certain differences, little nuances, and issues that are unexpected. Controllers will say a particular thing, give you a clearance, or something is a little bit different. It's going to adversely affect you, because you're not going to be able to anticipate everything. It takes once or twice to hear and understand what they're asking for. Once you've broken the code, it becomes essentially neutral. But there is a learning curve anytime you go into a new area or one you haven't been to for some time. You have to get on top of that learning curve. It's not necessarily a difficult learning curve. You may try to be more prepared to make up for that slightly negative aspect of it and compensate for it, but it's still there until you become used to the particular area that you're operating in.

It is just the way you refer to certain things. It may be that the way you use common English is different from region to region. Or it may be that very minor parts of terminology are just a little bit different from region to region. When you're not used to that, then you're approaching it from your perceptive and your recent experience. The more familiar you are with the region and the airport the less negative it is because you're used to those procedures. We've become creatures of habit, and there's so much going on in the cockpit from time to time that you have to rely on the base of the knowledge and experience that you've accumulated over the years.

[14]The differential use of hectopascal and millibars in some countries, as compared to inches of mercury in the U.S., can lead some international flight crews to set their altimeters incorrectly. See asrs.arc.nasa.gov/directline_issues/dl2_intl.htm for a comprehensive description of the problem.

The seasoned pilot

You can read about how they want you to do things, but until somebody's been there or done it in the order that each airport likes things done, it's difficult. But obviously, just like domestically, where some airports operate under their own — at some of the busiest U.S. cities, you know that the controllers are very efficient; they pretty much fly your jet, and you can trust a lot of what they do. When you go to some of the larger, non-native English-speaking cities, they basically say you have the field. They usually have inexperienced controllers at some of the smaller airports. You're on your own, so you have to be really careful, and that can be a challenge, too. Getting the gouge and asking someone who's been there recently helps because the book will tell you this, but this is how they operate. It's those different procedures at different airports — unless somebody's been there, you don't always know if what's written on the page is what you're really supposed to do.

Hand-offs

Some countries are better at giving us hand-offs than others. Last month, there were four times the controllers missed giving us the hand-offs. We had to do our own hand-offs. I write all the frequencies down so I know about where we change. In one country, the controllers never gave us a hand-off, so we dial up a frequency and say "hello."

There are things I have to do to manually compensate for the lack of technology to be able to hand-off clearances from one country or sector to another. When there are no automatic hand-offs between air traffic control sectors and regions, I have to do 10-minute prior calls. For example, 10-minutes prior to TADPO, which is a fix outside of the Havana flight information region [FIR], I have to call Havana to facilitate our clearance into Havana's airspace. If I don't do that, then the Havana FIR rejects us, and we end up holding until I can coordinate. As we travel through Havana's airspace and then 5-minutes prior to entering Kingston's airspace, I have to call Kingston, Jamaica and say, "Hey, this is me, this is where I am, and when I am estimated to enter their FIR." I do that all the way up and down as we enter and exit the FIRs.

Radar

In some parts of the world, I don't know whether or not I am under radar contact. I may be in radar, but they'll never tell me that we are radar contact unless I ask them. If we are in radar contact but it is phase-two secondary radar, then it is just a weather-paint. It is just a degraded system from the U.S. There's no attached aircraft call sign and altitude displayed. I'll do position reports with altitude all the way down to the final approach fix [FAF]. They'll give me re-routes really quickly and expect us to be able to do it. I mean, it isn't like I've been there for a 100 years.

Lack of Standardization

Different Airports Procedures

I tend to be someone that prefers a high level of standardization. So anything that's different from what our routine is or what we're used to has a negative impact on our flight. And with the experience that I've had flying in different parts of the world, I know now where I can go and have the biggest difficulty with communications, and it tends to be localized. There is a wide variety in how controllers in different countries operate, and sometimes it's inexplicable. Getting an explanation is very difficult sometimes because the language problems are just a radio saturation issue.

In the United States, there are very specific ways of dealing with traffic. They'll slow us down more quickly. The vectors are more efficient, and they tend to take place in higher altitude, as well as the slow-downs.

On the coast of one country, at 190 knots, I have to have flaps out. It's not like I get over there with a lot of fuel, and they've been doing it that way for a long time. I don't think there's any change, but you're in this big daisy chain with these 800,000-pound airplanes just following each other around at a snail's pace to the runway. In a large non-native English-speaking city, they point us at the airport and say, "Cleared to land." When we're 40 miles out, and if I don't have the situational awareness to know, I need to pick a point further away from the airport and be there with the speed and altitude so the airplane is stabilized. We've had people go around because the controller was too efficient.

As pilots, we can read about how they want us to do things, but until somebody has been there or done it in the order that each airport likes things done, it's difficult. In one country, it says to contact clearance delivery at engine start. Well, that doesn't mean you get to push back and then contact him for start. That means you need to contact him before you push back and you ask him for engine start, but it doesn't say that. It says contact for engine start, so you could easily construe that to mean, "Oh, I'm supposed to push back here and then call this guy." Well, that's not what they want you to do. In Cairo, they want you to pick up the clearance on the taxi out. That's very different as you well know, from the way that we do things in the States and different from any other European country that I've been to. I've never had to pick up the clearance during the taxi out.

Here in the States, different airports have different procedures. At one airport, I need to contact a gate controller, the next place I don't. Here, I need to contact Ground Control for push. Here, I need to contact a different ramp control for push back, and obviously those procedures need to be airport-specific because everything is so different. However, it adds complexities when you get these different procedures and all these different airports over the world and everybody does things just a little bit different.

Different Oceanic Procedures

Anything that's different from the ATC procedure that I'm accustomed to ends up being somewhat negative. The procedures for the North Atlantic Track system [NATs] and the procedures for the Pacific Organized Track system [PAC] are as different as day and night. The PAC is so easy, but the NATs are very difficult and demanding. It can be an absolute nightmare of overlapping nationalities and procedures, and it's

Table 11. Influence of Differences in ATC Procedural Complexities on Pilot Flight Experience.

ATC Procedural Complexities Influence on Flight Experience	Number of Pilots	Percent
To a great extent	0	
To a considerable extent	7	14.58
To a moderate extent	19	39.58
To a limited extent	22	45.84
Not at all	0	

changing on almost a daily basis as technology gets improved. The CPDLC, ADS,[15] who to call, what your clearance is, and when you get your clearance are all different. You can do a trip this month and you do the very same trip next month, and you could have written down all the frequencies, and who to talk to, and the timeline, and it will be totally different the next time you make the trip. It's dynamic because of technology, but I have found even in these days of technological advancement it can be inconsistent from time to time. If you happen to pick up a North Atlantic Track, your standard procedures are that you're deviating from what you normally do on a domestic flight. It actually increases stress, and you have to be a little bit more deliberate in what you're doing. You're thinking a whole lot more ahead. I just think that the stress load is increased because there are different procedures, and we are operating in what I consider a more stressful and more complex environment.

Terminology

If everyone has their own terminology or sequence of things that they will clear me for, and it's not what I am normally used to hearing, it's harder to understand that transmission. When something is different, that presents a threat; and even if it's a minor thing like a holding speed or a holding direction, or their terminology is "line up and wait" instead of "position and hold," or it is "taxi to," whatever is different, presents a threat because it has to be interpreted correctly. For example, I was given, "Cleared to follow Yugoslav dot-dot-dot." It was a 737 taxiing off on my right. And the terminology was different to me, so I readback, "I understand I am cleared to follow Yugoslav flight number dot-dot-dot." The response was, "Roger, you are cleared." So, that's what I proceeded to do. I followed a Yugoslav airliner. They came back and said, "Why did you cross the runway?" I said, "Because you had cleared me to follow the Yugoslav airliner." What he was saying and what I was interpreting were two different things. He wanted me to go behind Yugoslav, but not to follow him; in other words, he just wanted me to line up behind the Yugoslav airplane. He had cleared him across the runway; he had not cleared us yet. He just wanted me to fall in behind him. The clearance was not the way it would have been issued here in the U.S.

[15] ADS is a datalink application. Aircraft equipped with an Automatic Dependent Surveillance transponder send out a signal that is interrogated and automatically reports the aircraft's location. Verbal pilot position reports are replaced by ADS.

20. To what extent has the difference in ATC procedural complexities influenced your flight experiences?

In response to this question, as seen in Table 11, approximately 46% of the pilots reported the differences in ATC procedural complexities had a limited influence on their flight experiences, while approximately 54% reported either a moderate or considerable influence. Their explanations are grouped according to their circled selection from the interview materials.

To a Considerable Extent Explanation

Better Radar Coverage Would Help

In South America there is only 5% radar coverage so I think the answer to that part of the question, yes, it is an equipment problem. The radar coverage is around the coastline.

Planning Ahead

While driving to work I just start doing the tick-off in my mind's eye; this is the reporting requirement here, they're going to say this here, but they actually mean that. If we get, for example, a random routing going over the North Atlantic, we've got to make meteorological reports at all the different points instead of just when they want them.

If we get a random routing then they want a met report over each and every point. If we did that in the Pacific, they'd rap our knuckles and say, "Knock that off." If we do that in South America, they would say, "That's too much information, why are you bothering me with this."

During training, we have a lot of pieces of information, but really, the answer is having somebody that's been there before and showing us the ropes going over, and then coming back. Once that happens, I have a real database in my mind's eye. I thought this, this is what it really is, and that's what actually happened, so I can just tick it off in my mind's eye as I'm going to work. Then when I get there, it all starts pulling together, and all the threads get bundled into one cable at that point.

Standardization Helps

I feel as though we should have standardization anywhere I fly. I should expect that service, and pilots from other countries flying here should expect that same service. In other words, we are all best served by a single global standard.

One of the biggest problems is transition levels. There are some places where we fly into where we don't know the transition level until it's reported to us on the ATIS.[16] When we get close enough to where we can hear the ATIS, it will tell us — if we can understand it—what the transition level is. Then we can plan our approach completely. It may vary by 1,000 feet. One day it might be 6,000, one day it might be 7,000. If you're going to Tel Aviv, it is 10,500, and that really throws people off, because why would they have a 10,500 foot transition level? And that's just an example; it can vary, and you won't know it until it is broadcast to you.

The Captain is Right

In South America, a lot of controllers have the opinion that "el capitán" is always right. There is the hierarchy where the pilot knows what he's asking and the controller should not try to interpret anything other than what he's asking. If a pilot asks to do something, they approve it because the pilot knows what he wants to ask, even if it's dangerous. So if "el capitán" says he wants to go down to 6,000 feet and there is a 12,000-foot mountain in front of the aircraft, "el capitán" will get permission to go down to 6,000 feet.

In the United States and European countries, if pilots ask to fly into a mountain, the controllers are not going to let them. They're going to tell them no, while in South America, there are some places where you can request to fly into a mountain and they'll say approved.

Throughout all of South America…controllers will give us a clearance to another altitude if we really insist on it, even though that altitude might not be clear or just because they don't know it's clear. It happens occasionally where they do climb airplanes into each other. Venezuela is a little more restrictive, and Columbia is pretty good about it. As we travel further south into remote areas, they really would never stop us from doing whatever we asked or told them that we were going to do.

There are Differences

I've always loved the way they handle saturation at London Heathrow Airport; they just put everybody in the same holding pattern at different altitudes, and you just go around and around and you're looking right at Gatwick — there's your alternate. You're flying right over the top of the airport and you stay in a holding pattern, and they shake the box. The next thing you know, you're in line to come in and land on the runway. It is very simple — you know exactly where you are, you know where everybody else is at, and I always have respected the way they've done that, and can't understand why they don't adopt that in other places.

I just feel like I have to do a lot more work in order to fly to another country, compared with flying across the country here in the U.S. It seems as we review the data that we get, there are more problems in the international arena with missed communications, misunderstandings, different standard instrument departures, and different STARS than we have domestically. It's more complex, and it's quite a bit different.

It does take a significant amount of preparation to prepare for these differences. Even though the differences are small, the impact can be large if you're unfamiliar, not aware, or don't follow the procedures. So, we're all professionals, and we want to do the very best that we can. When I fly domestically I have very little preparation to do; however, when I fly internationally into various areas — particularly if I have not flown into that area recently or before — there is a lot of preparation and a lot of things that I do to try to prepare for that flight.

To a Moderate Extent Explanation

Familiarity Helps

The best training aid of all is some guy or gal that's been there. If somebody in the cockpit has been there two or three times and knows what to expect, you've got 90% of it knocked out right there. The rest of it is, "OK, now I'll take this piece of information, that piece of information, and make it all fit." Now, you can talk about it.

A lot of the time, expectations and reality are two different things. The procedures say you've got to make these reports here and there. No, not necessarily — not in real life. That's probably the biggest problem with it. That is why it seems to be so easy down in Latin America. As long as nothing's going wrong, we can do what we want and spare the met report. In Europe or on the tracks, just getting the report in is difficult; it's ridiculous. So until you've been there a few times and you know what to expect — how to fly a track, how to leave a track, these kinds of things within that system, what the expectations are, and what's really happening — it is a learning experience. Datalink helps a lot. If you have it, then you don't have to listen to all that stuff and give a report 10 minutes after it's due.

And if you say, "I'm declaring an emergency" or "I've got a fire onboard" in South America, it doesn't resonate with them the same way it does to an English-speaking controller. So, you really have to say "I have condition red MAYDAY, MAYDAY, MAYDAY" or "PAN, PAN, PAN" to get their attention on it. Then the lights, bells and whistles go off quickly. And that's just one thing to remember.

It is all Complex

When flying down to deep South America, you go through a lot of complex air traffic control procedures, deal with a language barrier, poor language skills, and the lowest level of technology down there. There are a lot of enroute communication changes. Some countries are not that friendly with each other, and they won't talk to each other. So, we have to make some of those hand-offs.

We can get a Panamanian controller who speaks just excellent English, but then we'll talk to somebody from another center who we can barely understand. We'll just hear "Roger," and we really don't think that they really understand what we were asking.

[16] Automatic Terminal Information Service provides continuous, automated, and repetitive broadcast of essential, but routine, non-control information in selected terminal areas.

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Everybody's so different in their procedures — for instance, going into the old Bangkok airport. I haven't been to the new airport yet, but I would imagine it's the same controllers. If you're going in, usually three airplanes arrive at the same time, and maybe a light civil jet, a Learjet or something. It shouldn't be a big deal for two parallel runways. If the civil jet is below you, even if he's behind you by 20 miles, they'll let him go ahead of you and they'll slow you down, or send you to hold. That's local knowledge, and the guy in the Learjet knows this, because you're looking at him on TCAS, going, "Why is he down there?" and he lands before you, and now you know why he's down there.

Maybe he's international, inter-Asia, but someone who knows the local gouge, and he's using it against the airliners because we don't know that. We're trying to stay high as long as possible and save fuel because that's the way we operate a big jet. But those kinds of things — strange holding situations, procedures where the clearance is to hold even though it's not on your flight plan — that's what you will do, and if you don't read that in your charts, you'll pass your clearance limit and start down some arrival that you're not cleared to do. And the next thing you will hear is the controller asking you, "What are you doing?" When, intuitively, you should continue toward your destination, via the arrival that is most likely that you're going to get. That's typically the way it works in the United States. When they clear me to Chicago, they expect me to hold if I don't hear anything else. It's a whole different set of rules that you follow when flying internationally."

Out of the Ordinary is not Good

It's very difficult to hear things that are out of the ordinary. For instance, when we were taxiing out of one major city yesterday, as soon as we taxied away from our gate, they tell us to taxi on taxiway Bravo and hold short of Runway 5 Left. As we were taxiing…airplanes were being backed out and coming out in front of us. An F100 pushes back and stops in front of us. The co-pilot and I were remarking that his right engine was running and his left engine wasn't. A gentleman was still plugged into the headset to the aircraft and the aircraft was just sitting there. We finally asked the air traffic controller about it, and he queries the guy, and we hear something in there about "singamutos." He must have been having a problem trying to start his engines, but when you can't understand a lot of what is being said, I have to ask myself whether I should wait or query the controller. Eventually we had to back taxi on the runway to get around this guy because he had some sort of mechanical problem. But it took three or four radio calls to ascertain that. I find that it is very difficult to understand anything that is out of the ordinary.

The North Atlantic has a very rigid track system. Hawaii is not quite so rigid going north-south. You can ask to go direct anywhere. If they don't have traffic, they'll let you do it. It is a little less controlling in terms of their rigidity. They have certain things that they do, but compared to the other places in which we travel, I think it's almost like flying VFR. Compared to other places within South and Central America, they let you do whatever you want. You can fly as fast as you want, usually; they try to accommodate your altitude requests. It's not that difficult to get a different altitude, but it's just less rigid, north-south.

Reporting Points Differ

There are different reporting procedures in different parts of the country, non-radar environments, and in the Atlantic versus the Pacific. When you get into Russia, they want three positions reported in advance instead of just the one and the two. You know that they're going to want all three times, which is not the normal reporting procedure, but for them, that's just what they happen to want. So we know that, we tuck it away in the back of our head, and we just start doing it. But we're talking about using abnormal as normal. For us, we enjoy doing that, because we're, "Hey, I can do this, I can make this work." But at the same time, should it be that way?

In the Atlantic, if your ETA[17] for another point changes, you have to revise your ETA no matter where you are but the parameters for making the change is different in the Atlantic than it is in the Pacific. For the Atlantic, it is three minutes and for the Pacific, it is two minutes. And in the Atlantic, a position report is made in such a way that you report your present position, the next position, the ETA, and then simply the position following. In the Pacific region, you report your present position, the next compulsory position, so you might skip over a non-compulsory position. It could be the ETA for the next compulsory one, and then the third report whether it is compulsory or non-compulsory. It doesn't matter. So, the Pacific is a little bit different.

In Russia, you'll make a normal position report where you're giving your present position, your next position, ETA, and then simply the name of the position following that. And they'll call you back and say, "What's the ETA for the position following that?" which really isn't a procedure anywhere. Then, when you're 2 miles from your next point they call you up and say, "You're approaching this point; contact the next frequency."

To a Limited Extent Explanation

The more you do it, the more you can rely on experience. I've been flying mostly Japan, and Japan is pretty straightforward and easygoing because everybody does the same thing.

With experience I think you're OK, but you're never going to be able to replace situational awareness by not knowing what the other aircraft are doing because of some controllers speaking their native language to their local traffic.

The biggest problem is that I don't get the information in the order I'm used to hearing it. We've been taught a certain way, and if it's not in that order, then we don't catch it as quickly.

We want to operate in a very small little box here. Maybe our abilities are out here, maybe the airplane's abilities are way out here, but what the airline wants is to operate in a small little box. So, it hasn't influenced my flight because I don't let it.

[17] Estimated Time of Arrival. For scheduled operators, in the U.S., it is the time the flight is estimated to arrive at the gate.

I don't let it get out to the point where it becomes strange for me to operate there.

We try to approach how we operate — no matter where we operate — the same. If we feel like we're being pushed in a direction where we're not comfortable, we will slow down and question and get back to where we do feel comfortable again. But I can see where the differences could affect somebody who may be cavalier or lax in the way that they perform their flights.

When operating in non-radar environments, you need to plan ahead. If you can get altitude changes with a center that has radar, you can get those changes very quickly before you get into a center that doesn't have the radar control.

If you've been down to South and Central America, you tend to think about that earlier as opposed to getting in a non-radar environment and wondering "Why don't we do something different?" Then it's like, "Oh great, why didn't we say that two minutes ago?" It would have been a lot easier for planning on the non-radar arrivals. For example, going into Cabo San Lucas, Mexico there are about six or seven different arrivals coming into that little airport. And in the green page, it says it's a non-radar environment. That's all it says. That really doesn't tell you what to look for. It doesn't tell what's going to be happening. Everybody's coming in from all over the place. And you're looking in the wrong places for airplanes because they are on some arrival that we wouldn't even consider doing. So until you've seen that a few times, you really don't think about it. But now I'm really expecting to hear airplanes coming in from all over and you kind of look for that. Again, I think experience level has a lot to do with it in these places.

The controllers are speaking to other pilots in the native tongue, which initially adds nothing to your situational awareness. They may have some local procedures, but once you've done it once or at most twice, you've pretty much broken the code.

On an 8-hour flight, the complexity is really only affecting a small amount of time. I mean, probably a little more labor-intensive than it would be domestically, but overall, the time span where it's an issue is minimal during the approach and maybe the enroute phase, especially now with our datalink clearance capability. It's almost painless because of the short duration it affects me.

Other Comments

Experience is the key

I would say just from the standpoint of the experience level that most of us are at by the time we're flying international flying, you know what to expect; and in general, you know the sequence of the process. And you can adapt to minor changes at a given airport.

ICAO Procedures are Better

I like ICAO procedures because they're standardized. One of the things that I see is that, I don't know that American controllers really operate that way very well. They don't always use ICAO standard phraseology, whereas a foreign controller will tend to try to do that unless they flat out can't understand what you're saying and it's time compressed, and there's a time-sensitive issue going on, and you're trying to get a landing clearance, and it's just not getting through. But when they do talk to you, they'll try to do it in an ICAO format, which goes a long way toward helping you to understand what they're going to say. So, if they can stay with ICAO, generally, you'll get to the right answer in some reasonable period of time. It's when the pilots — and it's typically the pilots — start speaking in non-standard phraseology, that's when things start to get confused.

The way we operate in the United States is not the way ICAO operates. I don't know that, for instance, a speed limit point going into London is an ICAO procedure. I don't know that holding at Compton is an ICAO procedure, is a U.K. procedure, or a London procedure. One thing about ICAO, I think more in terms of phraseology and in terms of what they expect you to do; how you comply with clearances, and things of that nature.

I Like Free Flight

I participated in a free-flight study in one of the 400 simulators out at Moffett Field. Now I realize how much influence air traffic control procedures have on every flight I do. If you take away the air traffic controller and the radio, suddenly flying the airplane is easy. It's dealing with the clearances and VORs, and going direct and trying to communicate with the controller. It's 90% of the workload, I think. And we take all that away with the free-flight experiment that we did and it was like, "Wow." We had ADS broadcast with the onboard displays that showed where you were. It showed every airplane within 20 miles and 4,000 feet of you. Level 1 was normal with how we fly now. Level 2 showed me the information, where the airplanes were, but air traffic control still controlled us. Level 3, we could maneuver ourselves, but air traffic control could intervene if they didn't like what we did. Level 4 was we turned the radios off and just did whatever we needed to do to avoid other traffic. And it would be very easy to do. And it just blew me away how much I would like to take off out of Los Angeles and fly anywhere in the world without having to talk to air traffic control and show up at a final approach fix at a specific time and then talk to a tower controller. Ninety percent of the hassle of flying is trying to talk to people and get clearances.

21. How would you describe the differences in ATC procedural complexities between international sectors and airports? For example, what differences do you think are notable between the North Atlantic Track System, the Western Atlantic Route System (WATRS) region, or the Asia-Pacific region?

Before providing the pilots' responses to this question, a brief overview of each track system is provided to familiarize the reader with the location of each oceanic region and some of its characteristics. To learn more about the North Atlantic, Pacific, and Western Atlantic Oceanic Regions, the reader is encouraged to read *Implementation*

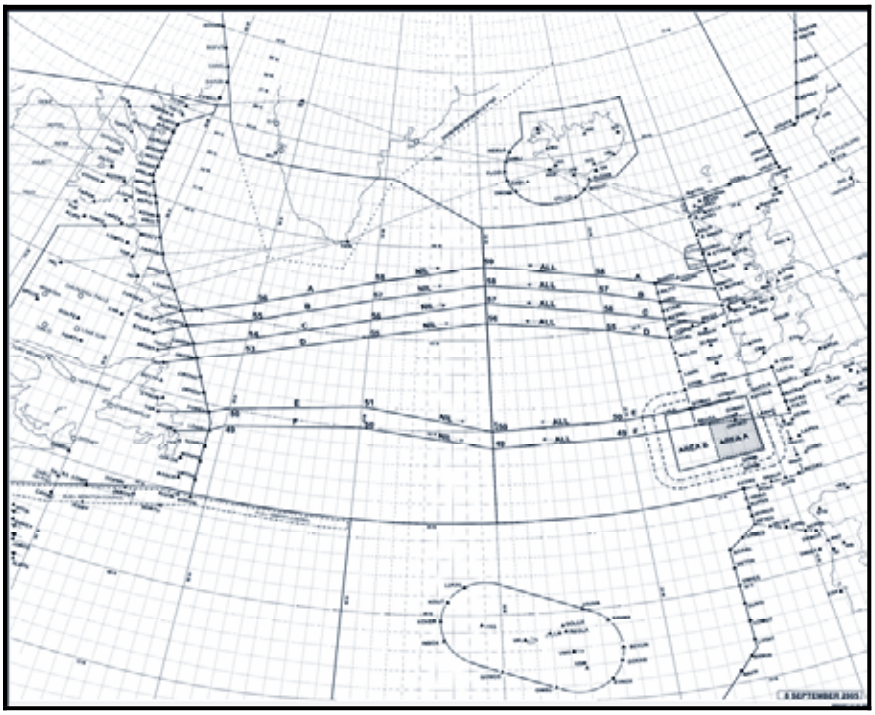

Figure 2. Example of Day-time Westbound Organized Track System

Plan for Oceanic Airspace Enhancements and Separation Reductions (FAA, 1999) and *North Atlantic MNPSA Operations Manual Edition 5* (ICAO, 2005).

Background: Regional Track System

North Atlantic Track System (NATS)[18]

The North Atlantic is the busiest oceanic airspace in the world. There are two different traffic flows between Europe and North America that arise due to different time zones, airport noise abatement procedures, and passenger demand. The Eastbound flow departs from North America in the evening (traffic peaks at 30°W longitude between 0100 and 0800 UTC). The Westbound flow departs from Europe in the morning (traffic peaks at 30°W longitude between 1130 and 1900 UTC). Gander Center publishes the Eastbound Tracks, while Shanwick Center publishes the Westbound Tracks (see Figure 2). These tracks are published daily. Furthermore, any NOTAMs pertaining to these tracks (waypoint changes, procedures) can be found by searching the ARTCC NOTAMs under Shanwick Center (EGGX), Gander Center (CZQX), Boston Center (KZBW), and New York Center (KZNY).

The North American Routes are a component of the NATS that consist of a numbered series of predetermined routes that provide an interface between the NATS oceanic and North American domestic airspaces. It is designed to accommodate the major airports in North America.

[18] Figure 2 was copied from NORTH ATLANTIC MNPSA OPERATIONS MANUAL on May 10, 2007. For detailed information see www.nat-pco.org/nat/MNPSA/MNPSA_2005.pdf.

Pacific Airspace

The Pacific Airspace is comprised of the North Pacific (NOPAC), Central Pacific (CENPAC), Central East Pacific (CEP), and South Pacific (SOPAC) regions. Each region has its own track system. As shown in Figure 3, for the U.S., the Pacific Organized Tracks System (PACOTS) is a system of established and published tracks. The Oakland Air Route Traffic Control Center (ARTCC) or the Japan Air Traffic Management Center (ATMC) establishes the tracks based upon user needs, military activities, weather, and other factors. The PACOTS provides routes between California and Sydney/Auckland. The CEP region provides an organized route system

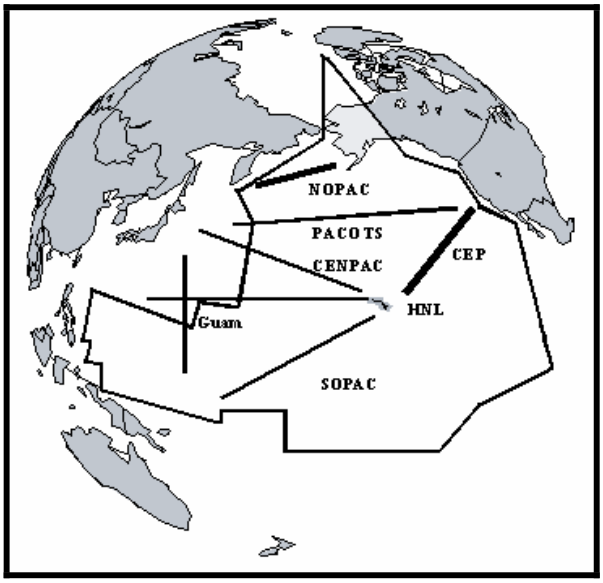

Figure 3. Pacific Airspace

between California and Hawaii. The NOPAC region is comprised of five routes that transit the North Pacific between Alaska and Japan. The active Pacific Tracks are stored within Oakland (ARTCC) Fremont, California (KZOA), and FUKUOKA/JCAB Air Traffic Flow Management Centre (RJJJ).

West Atlantic Route System (WATRS)

WATRS is an extensive network of routes linking points in the United States and Canada with Bermuda, the Bahamas and the Caribbean area, defined in the New York Oceanic Control Area to the west of 60°W. "The WATRS area is defined beginning at a point 2700N 7700W direct to 2000N 6700W, direct to 1800N 6200W, direct to 1800N 6000W, direct to 3830N 6000W, direct to 3830N 6915W, thence counterclockwise along the New York Oceanic control area/flight information region boundary to the Miami Oceanic control area/flight information region boundary, thence southbound along the Miami Oceanic control area/flight information region boundary to the point of beginning" (ICAO, 2007).

The WATRS is a complex, high-traffic area that is comprised mostly of fixed routes with a significant number of crossings. As shown in Figure 4, there are two dominant traffic flows in the WATRS region: One is between North America and the Caribbean, Bermuda, and South America, and the other is between the Americas and Europe. Details of these routes and associated procedures are contained in the *United States Aeronautical Information Publication* (FAA, 2007b).

Pilot Responses

The pilots' responses are presented below as they pertain to commonalities, differences, region/track/route, and specific issues discussed among the pilots. Their specific issues center around the following themes: (1) Altimetry: Millibars vs. Inches and Meters vs. Feet; (2) Call for Global Standardization to Make Operations Safer; (3) Lack of Radar, Weather, and VHF[19] Coverage Make it Difficult; (4) Language Issues; (5) Mitigation Strategies; (6) Technology Makes it Easier; and (7) We Need Standardized Terminology.

General Commonalities

Most Problems Occur During Takeoff, Landing, and Approach

Most communication needs to flow quickly, accurately, and in a more timely nature than it does when in the track system. High-density approach and departure corridors require more timely communications.

Tracks and Routes Present Few Problems

Once enroute, we have our clearance; we're at an altitude. There are few communications that actually pass between the airplane and the controllers in the tracks. There are occasional altitude requests for weather deviation, but there's not very much that happens.

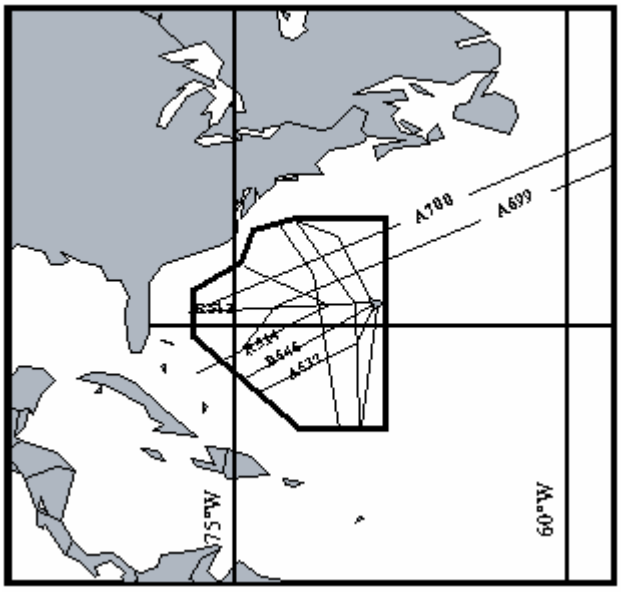

Figure 4. WATRS Airspace

General Differences

The voice procedures are different from the North Atlantic versus the Pacific. There are language differences and differences in language skills and procedural steps we have to follow that add to the complexity of flying. About 90% of the workload of flying is working the air traffic control clearance issues.

The procedures for Atlantic versus Pacific flying are getting better and more similar. However, in the NATS, our oceanic clearance is not part of our basic clearance; whereas, in the Pacific, "at the gate" is the clearance you get all the way across the ocean, and we're good to go. What makes the Atlantic more difficult is that it seems to be busier, since there is more traffic on the North Atlantic Track System, and we are talking to more controlling agencies.

There are differences associated with the North Atlantic versus the Western Pacific Routes and other parts of the world. Whether the procedures are more complex or not, I can't say — they're just different. I would love them to be the same. It's easier to have one set of procedures worldwide, and that's something for ICAO to work on.

The NATS is More Complex and More Challenging Than the Asian Pacific

The procedural complexities between the two are about the same; however, in NATS it is three pounds placed into a two pound bag because there are many more airplanes going over the same amount of compressed airspace, that to get a word in edgewise sometimes can take you 20 to 30 minutes, literally.

[19] VHF (Very High Frequency).

Automated Position Reports on NATS as Opposed to Hawaii

It's a little bit more automated going over the Atlantic now. They seem to concentrate now on getting datalink procedures up to speed, so now we have datalink going from this end, from Gander over where we can get the clearance. That's fairly new. Once we are in oceanic airspace we can get datalink. So, they concentrate it more there. I find the NATS to be preferable to anything else and not a hard thing to do. I prefer NATS to the less structured environment that we have in the Pacific.

Deviating for Weather

In the Pacific, the controllers are much more likely to rapidly clear you for a deviation for weather. They'll say, "Cleared, deviate up to 15 miles right of course." When we're in Gander's airspace, you'll get "unable." When there's a thunderstorm on our track, "unable" is not an acceptable choice. When you get an "unable," you look in the panel of the Atlantic chart, looking for the part where it says that you can deviate up to 5 miles at a particular location, and not say anything to the operator but just broadcast over HF what we're doing and why. It is not a good idea to fly into a thunderstorm. You can appreciate the radio operator saying "unable" because they've got so much traffic. We're talking to someone who calls the controller up and says, "This guy wants to do that," and they say, "yes or no," and he comes back and says, "Well, they said no." However, that's not always acceptable. As a result, you get that time-induced pressure to do something, and there are all these airplanes, we're looking at all these diamonds out there on our TCAS display, and sometimes it gets a little hairy, and that should never happen. When people start reporting thunderstorms, maybe they need to increase spacing, and slow traffic so aircraft in the line of a thunderstorm have the ability to get off the tracks. There are times when you just have to protect the aircraft and its passengers, and you deal with it when you land.

Reporting Procedures

The NATS seems to have a more rigid and inflexible structure. In the North Atlantic, if I give a procedurally incorrect position report over the radio, or if I don't give it exactly right, I'm going to hear about it, and then I have to get in line again. I could never understand that. Nowhere in the North Pacific or even going to Hawaii did it seem as big a deal. Same with getting a cleared altitude higher; they'll make you get it right, but they are more tolerant.

Differences in Track Predictability

I think the NATS is a nightmare of overlapping nationalities and procedures changing almost daily due to technological improvements. The NATS vary in location daily, with all waypoints becoming mandatory reporting points; not so with the WATRS. The differences in the NATS where the tracks vary from day to day are built every few hours; they change. In the Pacific, we just take off with a clearance, and a couple of hundred miles out they'll switch us. We won't talk on the radios anymore, but it will all be datalink, but it's very straightforward. But once we're used to, once I have experience in all three or four of them, then I realize that they are just different. Over the Pacific and especially the Atlantic, I've got to look at something to remind myself what their procedure is for the reporting. Many times I'll go back and make a report and then realize that, "Oh, I forgot this one particular word that they require." Like the exit point, entry point — going outbound or eastbound ATC doesn't require an exit point; coming westbound, they do and things like that.

Differences in Position Reporting

In WATRS vis-à-vis Pacific, the difference in position reporting is, or can be, confusing. One of the procedural differences I see is in position reporting, in let's say the Caribbean, the WATRS, North Atlantic, Asia Pacific, whereas you get the compulsory, compulsory, not compulsory position reporting sequence; and in the Pacific, you would do the compulsory, compulsory in the next fix position reporting sequence, whether it's compulsory or not compulsory.

In the Pacific, too, I think it's just that somebody needs to coordinate in-flight procedures for the Atlantic and the Pacific so that you know when you give a position report it's always in the same format. The chart will tell you how position reports are to be given, but they are different. So, instead of having it the same, our local procedures require a different format. They're really complicated. Even though they are charted, in some cases, there's ambiguity. For example, in the Atlantic on the southern routes, it's not clear who the controlling agency is. For example, we're going to contact Santa Maria but, in fact, it's in Europe airspace.

North Atlantic Tracking System

The NATS area probably has the more complex tracks to be flying on, and it has several different procedures. We have to consider differences in arrival and departure procedures, as well as fairly significant differences in speeds, transition altitudes, position reports, and FIR boundary crossing restrictions. The flying differences that I find confusing at times, and especially confusing for new pilots are changes to transition altitudes, transition numbers, altimeter settings, and that we're not used to such references for different types of weather phenomena or track emergency. If procedures were standardized, preparation would be easier.

Clearances Require Much More Effort

NATS is the most complex, as it requires the pilot to blend three distinct clearances into one executed flight plan. It requires a lot more coordination, and we're under a time crunch once we get airborne to get that flight plan coordinated. Sometimes we only have between 30 to 40 minutes to make it happen. First, we receive a clearance to the North Atlantic Track, which would be west of Great Britain, where the North Atlantic Track starts. So, we have a clearance to the track. One of the first things I do when we get airborne is try to get our second clearance, which will be the track clearance. Finally, while

on the North Atlantic Track, I have to get another clearance from the track to our destination in the United States.

HF Radios

NATS is a nuisance, largely due to primitive 19th-century HF radio communications. They're just horrible. Because the HF frequencies are the equivalent of a CB radio in the 1970s, very rarely can we understand what we're being told. Specifically, to get a clearance, we all listen so we would all agree to what is in that clearance.

Everyone is on the Same Frequencies

The other problem with the HF situation is that we're using the same frequencies in everyone's airspace. It does not matter in what part of the world I am in. It could be Santa Maria, Shanwick, or Gander. All of the pilots are using the same bands of frequencies. As a result, I may be waiting for Santa Maria to complete their position report with a guy down over Lajes, when we're trying to get our clearance with Gander up in the North Atlantic. When there is a sun-spot, it causes a compression of the frequencies.

HF Frequency Congestion

Sometimes it's an interminable wait to get all the HF frequencies. HF radio is nearly impossible because the airspace is too saturated in North Atlantic, and we can barely get on the radios, and I know that I need to get this done. So, even if I can get in, it's very crowded. We're not talking to a controller there, we're talking to somebody who's going to relay the message; he has to go relay it, and I've noticed that the NATS is the hardest for me in terms of trying to get new clearances. Gosh, it can take a long time, and it's just really something. In other parts of the world, it seems to be easier. And so, the HF frequency density of communications has become an issue.

Procedural Differences in the NATS

There are too many different procedures in use for transiting the North Atlantic Tracks, depending upon our entry and exit points. Some sectors are ADS and some are CPDLC. Nothing is standardized and it can be very confusing; not a good thing when there are so many aircraft so close together. Well, just to expound a little bit on the North Atlantic. One of the problems and some of the procedures in the international sectors is, while, theoretically, we get this stuff out of CPDLC, one of the problems that I have going eastbound is it depends on where we are. If we're coming out of New York, if we're coming out of Montreal's airspace, if we're up in Iceland's airspace, or Gander, as we go further north, the procedures become different. Iceland doesn't have CPDLC — they have ADS.

The procedural requirements are driven by Shanwick and Gander, and they have different approaches on what's acceptable. And they're at the opposite ends of the track. So we have special procedures when we are coming one way to get a clearance, and we have different special procedures going the other way to get a clearance. In the NATS, the entry points and the manner in which we get our clearance do change and is not consistent. If I look at the procedural requirements I have to do certain things within 200 miles. And the only way to really figure it out, if I don't already know, is to look at the Atlantic I chart. To do that, I have to fish through four pages of print to get the correct frequencies. Most pilots make their own data sheets that have all of the information they need and put it on their clipboard.

Every time I go there, something has changed. I either have to talk to somebody or don't have to talk to somebody. Sometimes I have to request datalink, and sometimes I don't. That's the difference between the eastbound and westbound Tracks.

Going eastbound, everything pops up automatically on our ACARS,[20] which is nice. And the only thing that the OCA wants from U.S. on the radio is our 5-digit clearance number. I also have to piece our clearances together in the Eastbound Track over the Atlantic area of operation. The Eastbound Track has very specific procedures: At this fix, we're going to do this to get our clearance, and I have to read this back. It is step-by-step rather than having to look here and then having to look over there, and so on. Although the information is on our high-altitude charts, it's not easy to disseminate. This is especially true if a crew is somewhat new or I fly it once a month. So, when I am the pilot monitoring, I have to get these clearances. It is one way going eastbound and a different way going westbound, and different for each controlling agency.

Sometimes when we go westbound, we can do it with datalink. If we are delayed, they'll want us to do it by voice instead of by datalink. Coming westbound from Europe, sometimes the first track entry point is at 10°W and sometimes it's at 15°W, depending on whether you come north of 18°N or somewhere else. Our routing will vary, depending on whether we're in Germany, or in London, or France. Depending upon where our routing is on any given day, I may talk to two or three more different agencies than I did the last time I flew to the exact same trip. So, the procedural aspects have the ability to differ from flight to flight on the Atlantic.

The NATS is Inflexible and Procedurally More Demanding

NATS is much more demanding procedurally than the WATRS or PACOTS. It also is more complicated, harder to understand and the most structured. For example, Mach number must be maintained on track. The North Atlantic tracks can get real complicated, especially during bad weather with people diverting. It is also more difficult to change altitude quickly to escape turbulence. There is a lot of traffic, so there's no room for leeway on the NATS. We have 30 miles before we are in somebody else's lap up there. As a result, we are less likely to deviate from a level track."

Volume of Traffic

I think the procedures are not complex but that the volume of aircraft going over at night is just so

[20] Aircraft Communications Addressing and Reporting System. Many of the routine messages formerly sent by voice are now transmitted by an ACARS digital link between the radio and ground.

tremendous that it is really hard to get a word in. And that adds to tensions going up in the cockpit, as we have to check in with Gander, get our clearances, get on the track, and so forth.

Pacific Airspace

The Pacific is a much wider space. The Oakland Oceanic area is huge. It goes out to, 165°E, which is just to the west of the Kamchatka Peninsula in Russia. It's almost over in Japan; Oakland goes way over there. Although the Pacific looks like tracks, they're really airways. The North Pacific procedures are slightly different than they are in the South Pacific.

The Asia-Pacific Routes are fairly simple, not complicated, and easy to understand. The Asia-Pacific area has procedures, but it's not as rigid, plus we have ADS now. I don't even have to send a position report because they take the ADS portion, and it reduces the workload and the likelihood of errors. I just use the CPDLC to request route and altitude changes. I make a SELCAL[21] so we're complying with the company requirement and to ensure that we have radio contact, should I need to talk with them.

As a crew, we really find out the chinks in the systems when we have a satellite problem and nobody's works. So, everybody's on the HF radio. That's when everything hits the fan, and there's a little weather thrown in, which is always the case when something goes wrong. And then we start to see the chaos that ensues when CPDLC and ADS are not available to make it easier. That really identifies the weaknesses in our procedures, when faced with a situation like that.

In the Pacific, the oceanic clearance is part of our basic clearance, and there are no additional procedural requirements to get the clearance. That is, we get our clearance to destination. It includes our oceanic clearance and our arrival clearance; it is a nice feature. And I am aware of stories of aircraft that have been turned around at the West Coast, not knowing that they didn't need a second clearance. They couldn't figure out how to get their clearance across the ocean, and their experience was all flying the Atlantic.

Hawaii

I fly to Hawaii occasionally and the position reports are pretty specific. I actually have to do a manual position report off a page that doesn't have all the information. If I mess up a position report, they'll make me get it right. It takes longer trying, it's a little bit more of a challenge, and it seems so routine to a lot of people. But when I do a flight out there, since I don't do it all the time, it's quite a bit different in some regards from flying in the Atlantic.

The Russian Routes (NOPAC)

If we read the wrong course, we are in restricted airspace. If I've got a thunderstorm in front of me, I'm going into restricted airspace if I try to go around it. You are locked on that particular routing.

[21] SELCAL is a selective-calling system that alerts the pilot or ground radio operator that communication over the HF frequency is necessary.

WATRS

The Western Atlantic route is "hands-off." By that I mean we basically have one clearance, as is customary when flying domestically, from takeoff to landing. And it's all datalink, so I don't have to talk to anyone. So we just keep flying along for hours without any communications. It's pretty nice. And part of the problems we have when we get into the WATRS is with the different transition altitudes.

Each Island is a Separate Country

Each island has its own procedures — some with radar and some without radar. Some areas require that you make a 5 minute or a 10 minute call-up before entering their Flight Information Region. We still want to follow the procedures as best we can, and the procedures change for each country. We may go through one area where the radar is only going to work during certain times of the day because they shut the generator off. Consequently, I have to understand when we're going to be giving a position report and when we're not.

Specific Issues Raised by the Pilots

During the discussions, the pilots brought up many points related to increasing international safety. Their issues centered upon (1) Altimetry: Meters vs. feet, millibars vs. inches;[22] (2) Call for Global Standardization to Make Operations Safer; (3) Datalink; (4) Lack of Radar; Weather; and VHF Coverage Make it Difficult; and (5) Language Issues.

Altimetry: Millibars vs. Inches of Mercury and Meters vs. Feet

Runway elevation

The other theater that has procedural differences would be Russia.[23] They have altimetry that is totally different than what we operate. They use QFE[24] instead of QNH.[25]

[22] There was a call by pilots for standard terminology. That component is presented under Language Issues.

[23] Visit the FAA Flight Standards International Operations' Web site for additional information regarding Russian ATC procedures: www.alaska.faa.gov/Internat/Russia/Russian_ATC_Procedures.cfm.

[24] QFE refers to the altimeter setting that will cause the altimeter to read the height above a specific aerodrome, and therefore, zero on landing. "The Russians use altimeter settings differently than most of the rest of the world. Russia uses a QFE system, where all enroute flight above 2,000 meters is done with the altimeter set to 29.92. When in an airport traffic area, though, the Tower gives altimeter settings which will read zero when the plane is on the ground, no matter what the field elevation is. Thus, their airport area altimeter settings provide AGL (from the reporting airport) readouts. This can result in a lot of knob-twisting during transitions and all but guarantees that you'll never know what your true altitude above sea level is during flight" (Highton, 1995).

[25] QNH is the barometric pressure as reported by a particular station. It refers to the barometric altimeter setting which will cause the altimeter to read altitude above mean sea level within a certain defined region. "The U.S. uses a QNH system, where altimeters are set to 29.92 in the flight levels, but are based upon corrected MSL readouts at lower altitudes. This means that U.S. altimeters read and are set to the actual field elevation when the plane is on the ground" (Highton, 1995).

Besides the problem between QFE and QNH are the units used to express an altitude.

Meters with Russia and China versus feet with everybody else, which can create other issues if we're not switching over and following procedures, but we're pretty standardized on that. So, we normally set our altimeter to what the field elevation is going to be. When we land in Atlanta, it's 1,026 feet above mean sea level and when we land at JFK Airport in New York, it is 13 feet above mean sea level. That's what our altimeter says. When we land at any airport in Russia, it does not matter what the altitude is of the airport, the altimeter will read zero. So that's a procedural complexity between different regions.

Flight levels

QFE procedures are problematic. When you transit Russian airspace, you go to meters for our flight levels. Well, the Russian Federation uses it, of course. China uses a different meters structure than Russia or Mongolia; and yet, they're adjacent countries. So you may be operating in meters at the equivalent of 36,100 feet. When you cross over to China, we're still operating in meters, but they want you to climb to what would be the equivalent of 36,400 feet. And it's a whole different set of charts.

China's meter structure is different from any other meter structure anywhere else in the world. All the Russian Federation States and Mongolia are one set, and China is another. And in our aircraft, we have a chart, or it's a card that has both charts on it. That's one of the briefs that I have to make sure the guys know when we're flying, say between here and Beijing. Between Newark and Beijing, we're going to transit Russia, and then we're going to transit Mongolia, and then finally, China. When they leave Mongolia and go to China, the Chinese are going to tell them to climb. It may only be a couple hundred feet, and they might think, "That's an odd clearance; we're just changing a few feet." It's to align with their structure. That is problematic. I think it's confusing.

Transition altitudes and altimeter settings

Also, some countries use meters, whereas others use feet. There should be standardization throughout. I don't see why we have to descend, change our altitude, flight levels, transition altitudes, or low altitudes. In the U.S. we change our altimeters at 18,000 feet.[26] It gives us time to prepare brief approaches, and to me, getting down to 5,000 or 6,000 feet in bad weather without changing our altimeters could cause a lot of danger if we're not careful. I always ask the question, "Why don't we have that worldwide?" I mean, it would be so much simpler if we would just say 18,000 or 20,000 feet, somewhere up high before we get down to the terminal areas and the terminal. But the equipment today reminds us, tells us that we forgot to change the altimeters, which is helpful for me. So, the airplanes are getting smarter and smarter for us.

An example

Getting down low, though, and changing has caused problems. There was one of our flights going into, I believe it was a British airport, and on descent, was cleared to an altitude below the transition level. They had set their altimeters to, the number was 9 9 2. They had set inches, and the standard they were using over there was millibars. It resulted in a difference of 600 feet or something like that, so much so that the supervisor got on the radio at the controlling facility, and said, "Verify your altitude." The FO said, "Four thousand feet." They said, "Are you mode C? Our transponder is showing you at 3,200 feet. Do you have ground contact? If not, climb immediately."

That sort of thing, and that's exactly what had happened.[27] He'd set 9 9 2 inches instead of 9 9 2 millibars. They saw the problem, corrected it, and got back up there. But that could have been a mishap — they were very low to the ground. And I think that would have been prevented had there been a higher transition level to begin with. If they could have just known that at 18,000 it changed, then that would have never happened.

That would be my point, everything should be happening prior to at least 10,000 feet before we descend; 18,000, we're so used to here. I feel as though it should be the higher altitude, so when you descend below 10,000 feet anywhere, we're adjusting our speeds and our altitude, the altimeter should be set at that point, our checklist should be fairly well taken care of.

Call for Global Standardization to Make Operations Safer

What I think we're all talking about here is standardization. We really need global standardization to make operations safer. Standardization, in not only procedures, but also in speeds, transition altitudes, boundary crossing restrictions, when you have to call ahead for a clearance to enter an FIR, and when you could just go. They are not at all standardized throughout the world. We can see that on the charts for the Caribbean and just about everywhere else. They're all different. So, procedurally, the differences from one section of the world to another are pretty dramatic.

Clearance Delivery Procedures

The clearance delivery procedures have several components. They include where pilots are when they get their clearances (Phase of Flight), how they go about getting them (Communications Protocol), and whether traditional voice radio or datalink is available (Use of Digital Systems).

Phase of flight

Well, it all depends on if we're within 90 minutes of the coast out point. If so, then I can call on the ground and get our clearance. In some places you

[26] Transition levels are dependent upon the country's airspace that the aircraft is in. They vary from as little as 3,000 feet (The Netherlands) to 18,000 feet (U.S. and Canada).

[27] Switching from inches to millibars (or millibars to inches) can be confusing for the pilot because it is a two-step process: (1) setting the numbers; and (2) setting the unit of measure.

can get our clearance on the ground. In some other places I can get it in the air and they make a big deal about it if I screw it up. So that's something that needs to be pretty well documented on the NOTAMs. If Stateside, I normally get our clearance via datalink.[28] If procedures were standardized, preparation would be easier.

Communications protocol

There are some fairly significant differences in how we obtain our clearance. The controllers don't always follow their own procedures, so sometimes our Flight Operations Manual procedures don't work. They're based upon what the controller said that they will do — not variations. Some of them want me to read back a track indicator message, assuming we're on a track. Up until a few days ago, going through Gander to Europe, I could send a message out asking for things like our mach number, our second altitude choice, and they would send us a message back, and I would acknowledge that in ACARS, and that's all I did.

Well, about six months [later] we went there again; Gander wasn't even a choice of ATC facilities, so obviously we're not doing that anymore, although we didn't get the word that we weren't doing that. Gander knows we're not doing it, so we just ride along passively and wait for them to send us a clearance automatically. Then I have to contact them by voice, but I didn't see any PSPD[29] or NOTAMS, so we bombed out, and that's the way it is.

Use of digital systems

We still have issues with standardization of the use of the new digital systems. Some airspace will use all the capabilities; some will just use part of it, but still require manual position reports, and some are just totally hands-off. For example, Anchorage tends not to use the full capability of the system yet. Japan has just gone to datalink and is using the full capability. They're using everything, the CPDLC,[30] and the ADS[31] systems.

Meteorological Reports

In a meteorological report, we give our winds and temperature and cloud conditions and ride normally speaking. Sometimes, depending on which airspace we're going through, the reports are not necessarily complete reports. They may be the next position, our altitude, and "have a good day" kind of thing, and that's accepted, or I can go through the full report and then find that I don't need to give all this information. So, again, it's based on experience.

The position/mets reports are a little bit different and more structured in the North Atlantic as it needs to be with the volume of traffic. Going to South America seems to be a little more of a relaxed environment only because it's not as structured, and maybe it's because the traffic volume is not as great as going on course to North Atlantic. When we give a position report, it follows this exact structure every time in the North Pacific, and people do that. It comes out right, and you hear back what you expected to hear back, so it's usually pretty good. And as far as going to Honolulu, using the reporting system we include winds and temperature, where we don't do that in the North Atlantic unless it's a specific report required. We can read this on the charts going to South America; we're required to give a met report.

No More Big Sky Theory

Coming out of Europe, if we're North of sixty-one ten, we go to Iceland. These guys all listen to each other and we wonder why it isn't the same. All it is doing is reducing safety, because the aircraft are so close together because of GPS over there. They're a wingspan of each other, and they're within 1,000 feet vertically. If we're on the same track, or the same random route — which is kind of an oxymoron — GPS takes away the "big sky theory," so there is no margin for error anymore, and only 1,000 feet apart with a closing speed of 1,000 knots. So, I would think that we would want to make it as standard and as easy as possible.

Reduced Vertical Separation Minimum (RVSM)[32]

I had a question about the RVSM phased in over the different areas of operation over a period of a couple of years. And that was one of those issues where we had to have equipment in our aircraft to comply with RVSM, and there were some different procedural requirements and capabilities of the aircraft even to enter the airspace. I'm assuming everything is going toward RVSM, and all of the knowledge that I have in one RVSM airspace will apply to others, but that's not necessarily true. Some have slightly different requirements, different aircraft performance capabilities. If our aircraft degrades, then we have to look at the airspace we're in to see if we're still capable of flying in that airspace.

Datalink

Pilots discussed two datalink applications: Controller Pilot datalink Communications (CPDLC) and Automatic Dependent Surveillance (ADS). Not all pilots have access to these applications since it is aircraft and company specific. One of the pilots did a very nice job presenting us with what datalink is, how it works, and what pilots have to do to use it.

Overview of CPDLC and ADS

I would say that the datalink equipment is really aircraft- and model-specific. datalink is pretty much automatic. There are two little prompts on our computer — one for ADS and one for CPDLC. They require that you log onto an agency to be able to conduct a

[28] Here the pilot is referring to pre-departure clearances that are available to the pilots operating in the U.S.

[29] PSPD is a posted bulletin. It's a military concept where, effective immediately we want you to do this now; we don't have time to wait to get it in the book. And theoretically, at some point it's supposed to go into the book.

[30] CPDLC refers to Controller Pilot datalink Communications.

[31] ADS refers to Automatic Dependent Surveillance.

[32] § FAR 91.706 Operations within airspace designated as Reduced Vertical Separation Minimum. See appendix G. RVSM was implemented to increase system capacity by reducing the vertical separation from 2,000 feet to 1,000 feet between aircraft that fly above 29,000 feet. Only aircraft with specially certified altimeters and autopilots may fly in RVSM airspace.

datalink session provided that the datalink is working. You can go in and there's a page on our ACARS where you will go in and select up to 90 minutes before you enter Oceanic, and you can request our clearance. And then it will come back with the clearance, you review it and then you accept it.

ADS is a system that downlinks our position, our speed, and our altitude. It is for surveillance. With ADS, we're out of the loop other than having our equipment set up and being airborne. We can't talk on ADS. The ADS sends our position reports automatically. Our transponder is interrogated to find out where we are. We don't even know they've taken a hit off of us. Automatic position reporting is nice because it has cut down on button pushing a little bit. Giving position reports is a non-event. And that's why I said, heaven forbid you had to do position reporting by voice. Now it's a check-in and a check-out. So, it's a whole lot easier than it ever was; I'm rarely using HF when in the Atlantic.

CPDLC is for the two-way communications, and we use it to send what we would typically say over the airway to a controller. It is a text message. Clearances are all through CPDLC. If we want to make a request, we do that via CPDLC by pulling up canned messages like, "Request higher altitude due to performance." When you send a message, the controller will look at it, examine traffic patterns, and either say, "yes" or "no," or "standby." We can still call the controller on the radio to request different altitudes or offsets for weather, or what have you. So, we still do have that two-way communication.

You need to check in when you depart the domestic airspace, and then you check in on an HF frequency, so there you go; you give them a SELCAL check so they can get a hold of you on the radio if necessary. And then at 30°W, you'll give another check, so other than that, because we're going from Gander to Shannon, basically what you are doing at Gander is saying, "Hi, and here's my phone number if you need to get a hold of me."

Accessibility to Datalink

Datalink was very confusing to most of our pilots when we first began using it because some theaters only had either CPDLC or ADS. The use of CPDLC and ADS in the NAT system is the best at present. Then the Asia/Pacific with Oakland has both CPDLC and ADS. Japan has CPDLC, but not ADS.[33] So, you have to send position reports; fortunately, it's still through the CPDLC. It's not via the radio, but you must give compulsory or compulsory plus the next position in our position report, and you have to know the sequence of that versus other parts of the world. Iceland has limited CPDLC as far as how much they can use the communication part, but they do have the ADS so you can eliminate our position reports. The Arctic only has HF.

We have cards in the airplane that give us examples of what the procedures are in the Atlantic versus the Pacific, Japan, Gander, Shanwick, etc. We had to learn what they wanted by sending representatives to those sectors and find out exactly what they wanted to hear from us. And then we codified it.

[33] Although contradictory with comments made by another pilot, it may be that Japan had not gone operational when the pilot flew there.

Technology Makes it Easier

The verbal check-in procedures are still used with datalink, but they vary with the region. Some controllers still only have HF radios, so we're doing everything [e.g., position report wise] via the HF radio. It is a standard position report that includes our current position, our next position, the time, and the following position.

Before the advent of CPDLC, there were different procedures as far as making reports over HF. But the datalink system is a very huge jump in technology in improving our system. We don't have to worry about weather affecting our HF radios like we used to have quite as much. We still need to have an HF as a backup to fly in this airspace, so we all need to be aware of how to use that procedure if we've got to use it as a backup.

Other than the verbal check-in, datalink doesn't change our cockpit procedures. We still have all the other mechanical devices of maintaining positional awareness, other than the verbal radio call, which often was getting pushed off because of congestion on the radios. It might be 10 or 15 minutes after that position was actually crossed that we're finally getting the report off to a middleman working with the HF system. We're talking to a commercial radio operator who has a phone line to the folks who need the information and are using it for separation. With the datalink, we're going direct to the user of the information. And if there's any need for them to clarify, they can just come back up with a message saying, "We need your position report," or "Please verify altitude," whatever it might be that they need.

Asia-Pacific

Going Asia-Pacific, my goodness, we've got CPDLC over there now. We never have to wait except maybe when we're checking in on HF frequencies. I call in and say, "We're CPDLC," and it keeps sending out the position reports. I have to call once again when I go on the other side. When we check on coming out of Tokyo, coming across the Pacific, they want to know departure point, where we're going, and the type of airplane. These are things that are required.

Atlantic

In the Atlantic, they just seem interested in hearing us say, "we're CPDLC," what our next sector's going to be, and giving them our HF assignments.

On the triple seven it is a little different, because we have a CPDLC that gives us our clearances. It is totally automated, which is really nice. There's a lot less confusion with that. They basically e-mail clearances to us. For example, when we're at 30°W, they tell us a time to switch to a certain frequency. We communicate via SATCOM.

Lack of Radar, Weather, and VHF Coverage Make It Difficult

I can deal with the language barriers especially with a little bit of experience, but it's a ground-based equipment problem more than anything else that gets us. When there is a lack of radar coverage, it changes our thought process completely on what

we're going to do. We'll go for the longest time and just completely go without any kind of radio coverage whatsoever.

When we are on depressurization routes, we are at the most critical aspect of our flight. The highest threat of that flight is when we lose our radio contact. And that is purely a ground-based equipment issue that we don't have in Europe.

Africa is going to be like South America was 10 years ago. We do these procedures called in-flight blind broadcast, because there's no radar, there's no VHF coverage. We're communicating with other airplanes, telling them where we are, where we're going, what our altitude is and when we're going to be there. Communications are strictly airplane-to-airplane. There's no controlling agency on the ground whatsoever. Besides the language problem, there is going to be an equipment issue there as well. It's talking in a tuna can.

Language Issues

In this section of the report, pilots focus more on their experienced problems with cultural differences, poor English language proficiency, pronunciation, speech rate, and terminology. All issues are presented alphabetically and are elucidated below. It was surprising that pilots spent little time talking about their language issues during the enroute phase when on the NATS. However, their explanations do provide some clarity as to why problems are more likely to occur at some point along their routes than others.

Cultural Differences

The problem isn't just the language barrier; it's the fact we're dealing with so many different cultures.

The pilots spent considerable time discussing the cultural differences in response to Question 18B (p. 11) and Question 20 (p. 19), and the reader is referred back to those pages.

During High-Density Phases of Flight Problems will Occur

Tracks and routes present few problems. High-density approach and departure corridors require more timely communications. And I will tell you the truth, I find that once you are in the track system, whether it's Atlantic, Pacific, or Asian, there are a few problems. Once we're enroute, we have our clearance; we're at an altitude, we're on a track, and there's very little that changes for 5 or 6 hours.

The difficulties, if there are going to be any difficulties, occur in the high density phase of the flight. That would be take-off, landing, and approach. Most communication needs to flow quickly, accurately, and in a more timely nature than it does when in the track system. There are few communications that actually pass between the airplane and the controllers in the tracks. Occasional altitude requests for weather deviation, but there's not very much that happens. And you get out there and perhaps 45 minutes will go by and you won't even make a transmission.

Poor English Language Proficiency

The language barrier is a definite problem. In some areas, I'm not sure the controllers have a clue what they are saying. As you go into some areas the non-native English-speaking controllers speak horrible English. But for the most part, as you are cruising, you have plenty of time to ask questions because they don't have the traffic volume. If you don't understand the clearances, you can get by the language barriers pretty easily there.

Pronunciation

Some procedures are different and some non-native English-speaking controllers and radio operators have language barriers. So we put on our "foreign language ears" and get used to the accent. The biggest thing with the non-native English-speaking controllers is when you get in their airspace, their English is quite good, but their pronunciation, i.e., their accent, is difficult to understand. So, a lot of times it is best for both parties to spell things. That way neither of us makes mistakes.

One thing we haven't mentioned is that a lot of the intersections sound alike in a lot of countries. To their controllers, the intersection names sound totally different. Pilots will be cleared direct to a fix and go to the wrong one. If our charts spelled fixes, intersections, and waypoints phonetically, it might help.

Speech Rate

In some countries, controllers and operators speak at a rapid pace. The farther north you go and the farther south you go, they speak at a much slower pace.

Terminology

We need to standardize terminology. It would remove some of the ambiguities that we have to deal with when we're new to an area. For example, "taxi into position and hold" versus "line up and wait," or "cleared ILS 9R approach" versus "join the 9R ILS approach," and "cleared final" versus "cleared approach." The "taxi into position and hold" versus "line up and wait" clearance can be very unfamiliar to somebody that hadn't flown into Europe before.

In some countries, the terminology for the approach — "turn right heading one one zero to join" —is the clearance for the approach. However, there you have to be cleared final to descend. That's different from what we do in the United States. The first time you hear that clearance there will always be the question in our mind: "Well, am I cleared for that? Am I cleared to descend on the glide path or what?" We are relying on our common experiences or different experiences between the three crewmembers. Somebody will usually have the answer to that question, unless we're all three new to the theatre. If we could standardize more of those things we would remove some of those ambiguities that we have to deal with when we're new to a new area."

22. To what extent is your performance impacted by different ATC procedure implementation or interpretation between international and U.S. airports?

Table 12. Extent to Which Pilot Performance is Impacted by Different ATC Procedures.

Impact of Different ATC Procedures on Pilot Performance	Number of Pilots	Percent
To a great extent	1	2.08
To a considerable extent	2	4.16
To a moderate extent	15	31.25
To a limited extent	25	52.08
To a very limited extent	1	2.08
It depends	1	2.08
Not at all	3	6.25

Table 12 shows 40 pilots reported that different implementations or interpretations of ATC procedures affected their performance either to a moderate (31.25%) or limited extent (52.08%). Only three pilots reported that their performance was not impacted upon by ATC procedural differences between international and U.S. airports.

To a Great Extent Explanation

Clearance Interpretation

My performance is impacted by trying to interpret what ATC wants me to do. The specifics are clearances and radar vectoring. An example of clearance interpretation happened about a year ago. We had a flight crew that got violated going into Sào Paulo because of a "cleared direct" clearance. ATC gave them a clearance; a lot of times they will say "cleared direct" as "cleared direct to the airport," "cleared direct there from the boundary," or wherever they want — where they're taking you — they'll say "direct to that point via your flight plan route." And the controllers did not understand that, and the pilot went direct to where he thought that ATC was sending him — you know, direct. The pilot and controller had different interpretations of the meaning of a "direct" route.

We also had a Mexico violation when a crew was coming out of Mexico on a departure with altitude restrictions. When ATC cleared the pilot to his approved flight level, they wanted him to meet all the restrictions on the departure. Apparently the pilot and controller had different interpretations of altitude assignments on the SID with printed restrictions. In Mexico, the pilot is still responsible for those immediate altitude restrictions. Look at the difference; when we get those kinds of clearances in the United States, those restrictions are removed. With the clearances and radar vectors that you get from a U.S. controller, you know where they're taking you and what altitude is expected. Also, in Europe they clarify clearances.

To a Considerable Extent Explanation

Altimetry

In Russia, it's the meters thing. Their flight levels equate to basically 1,500-foot separation, approximately, so someone coming in the opposite direction should be about 1,500-feet above or below you. So they're, hopefully, RVSM. I think Beijing is probably the most unusual because you actually land in meters. Plus, you're in QFE.

Culture

The mindset shifts; the mindset is different. For example, in Europe, it's pretty much ATC is, "I'm going to tell you how you're going to fly this airplane." And in South America, it's pretty much, "ATC, this is where I'm going. You got a problem with that?" And it's much more directed from the cockpit to the ground, versus over in Europe, where it's much more directed from the ground to the cockpit.

Language Production

At Beijing you're dealing with the controllers' accents all the way to the ground and to the gate.

Procedures

Within the U.S., ATC procedures are standard, while international procedures can vary depending on the country.[34]

Workload

The time that you encounter these differences in procedures and policies is when you're most tired. One of our long flights to Hong Kong can be 15 hours. So, it's the complacency combined with the fatigue factor. The time when you're most challenged is when you're the most tired.

In Russia, when you give the compulsory reports, ATC wants to know everything. They want to know every time you do anything; even if you're on a published route, they want to know when you make a turn. Even if you're on a published arrival, every time you cross over a fix they want to know it. Every time you leave an altitude, they want to know. When you arrive at an altitude, they want to know. And then every time you make a turn to another fix and every single turn or any change you make, they want to know on the radio. And that's something you don't find anywhere else. Plus, you're in QFE, using meters; and you've been up flying for 12 hours and you're only going in there because you've lost an engine. You've got a lot going on there.

[34] Input on the theme "Procedures" varies from standard to non-standard, country to country, throughout the questionnaires/interviews.

To a Moderate Extent Explanation

Communication

There are two components to communication as discussed by the pilots. The first is the improvement in procedural implementation attributed to datalink. The second is the decrement in procedural implementation attributed to difficulties in communicating with controllers who are non-native English speakers.

Datalink

As far as implementation goes, it seems like the more and more we go to datalink, the better and better it gets. The less you have to get on an HF radio or VHF,[35] then get in line and maintain any kind of communication that way, the better it is. From both the pilot and controller ends, you can actually kind of manage that communication when it fits for you. With datalink, it doesn't have to be sent immediately. Maybe you have something going on and you can just wait, and when it comes across, it's in plain English that everybody can understand. So, I think the more automation, the better. It gets rid of the accents, it gets rid of the dialect problems, it gets rid of the pronunciation problems, gets rid of the controller that maybe just doesn't speak very good English. Familiarity helps with the accent, but while you can simulate the procedural clearance issues, you cannot simulate a Scottish controller's brogue accent.

Language Comprehension and Production

If you have a language barrier — somebody has an accent or you're dealing with a non-native English-speaker — it's always a little more difficult to understand. In Japan's, China's, and Russia's airspace, ATC doesn't have the ability to cope with fast-moving situations like weather deviations or turbulence, and I think they have to stop and think of how to talk to us in English. Things start falling apart and the communication stops. The English limitation increases their frustration level. I'm sure it would be nice if there was at least one controller in every sector that was very fluent in English — our native English.

Culture

I get frustrated sometimes from ATC in foreign countries, using their procedures versus ours, such as meters. It affects my airplane's performance; my fuel burns. I may not be able to climb 4,000 feet. When you go down to the Caribbean, Honduras, Costa Rica, and some of the smaller airports, they don't hold your hand through the approach. You're expected to know how to do an ICAO procedural turn and their procedures down there.

Procedural Interpretation

I think my performance is impacted because of the differences in procedural interpretation. About 90% of my work is trying to interpret their procedures, which are different to me every time I go somewhere new. A simple thing like an ETA is different, and you need to be aware of that.

In the U.S., there are a lot more approaches or arrival routes, followed by a radar vector into the pattern behind some other aircraft whereas with radar vectoring in other places, you'll either continue on your route, or if they need to adjust your position in line they'll say "After this point instead of going to Lucia, you're now going to go straight to Mateo." But once you get onto the approach, the routing leads you into the airport instead of the controller vectoring you all the way in and the altitude restrictions have to be kept up with all the way around. The difference is, in the U.S., it's radar vectors and with controllers in other countries, you fly the complete approach. Here in the U.S., the controllers are telling you what to do, especially when you're coming into big airports. They're controlling your airspeeds, your headings; they're doing everything for you. But when you go down to some of these other airports in the Caribbean, Honduras, Costa Rica, and some of the smaller airports, you really have to plan ahead on your approach. They're going to give you a number of different ICAO procedures.

Airports use different procedures for clearances and taxi clearances, and departure and arrival procedures. At some airports, the procedural differences begin before you even move — for example, when you call for your clearance, when you know to call for push-back. There are specific issues that differ even within the same country at different airports. Another example would be that in certain parts of the world when you're cleared for take-off, you automatically switch over to departure control. In other places, you have to be cleared to departure control. It's purely a regional difference, and I'm sure it's an interpretation of the ICAO rules. In China, it's altitude restrictions. In Europe it's speed constraints. There are numerous examples of clearances.

Radio Coverage

In the U.S., the air traffic sectors are larger, and you can hear up ahead what's going down, whereas in Europe, they tend to be more compressed. You're switching frequencies pretty rapidly to different sectors, and so you really don't have the time to hear what's going on ahead of you.

Radio coverage in some areas of the world is limited. If you are diverted into a remote airport, a lot of the time the cell phone is the only way that you have to talk, unless the local authority will allow somebody off the airplane for a landline.

Terminology

My performance is affected to a moderate extent by the ICAO terminology[36] that is not consistent in all regions of the world. In China, you are expected to comply with altitude restrictions even though you are cleared below.

Training

It requires training in a group prior to each flight. We train in the simulator for each of the major international country procedures, but we can't simulate the

[35] HF (High Frequency).

[36] Throughout the questionnaires, the pilots seemed to use terminology and phraseology interchangeably.

communication accents. We rely on the "bunkies"[37] a lot. If it's a continuing problem that the fleet notices, they will put it in their 10-7 pages.[38]

Workload

About 90% of my workload is trying to figure out how to do the procedures for that country and that airport. The airplane flying part is like walking and chewing gum. It's the procedural stuff that gets complicated.

Well, it does seem like in the U.S. that there are a lot more approaches or arrival routes that would get you close to the airport. Then you're radar vectored into the pattern, cutting off a little bit of a dogleg.[39] But once you get onto the approach, at that point the routing leads you into the airport instead of the controller vectoring you all the way in. You do have to review the charts a lot more seriously. In some foreign countries, there are a lot of altitude restrictions that you need to keep up with all the way around, instead of how radar traffic is handled. You fly a more complete approach versus being vectored off to the final here, in a lot of cases. Fatigue is a definite function of what you expect to hear and what you do there. So, the workload and the potential performance workload is increased greatly, I think.

23. Is there any incongruence between what you would normally understand is written (on a procedure) and what the controller instructs or expects you to do during a flight? For example, some controllers in some countries believe that a "Cleared Direct" instruction means that the pilot is expected to fly the currently filed track over the named waypoints "directly" to the airfield. Other controllers in the same country expect a pilot receiving a "Cleared Direct" instruction to deviate from the previous route clearance and to fly on a straight track between his present position and the point mentioned to which he has been cleared.

Forty-two pilots (87.5%) commented on this question, and the remaining six pilots (12.5%) either saw no incongruities between the written procedure and the controller instruction or expectation, or they provided no examples. Responses were organized into three themes: (1) Methods of Dealing With Incongruities, (2) Practices or Terms Used by Controllers, and (3) Written Procedures and Controller Instructions and Expectations.

Methods of Dealing With Incongruities

Company Policies

The company puts out pretty good information that keeps us up to date on procedures and phraseology, such as "line up and wait." The differences are well spelled out in our manuals between the Flight Ops Manual and the region chapters, and then the specific states for the area we fly to. Anomalies, like the differences in the clearances and altitudes and profile on the lateral and vertical, are fairly well spelled out in there. Usually differences such as the above would be explained in our regions chapter or area briefing. Those are things you learn from experience and pilot reports that are particular to an area. We try to be very diligent to put those things that are an immediate issue into a bulletin. It contains time-sensitive information that we put out to pilots right away then we incorporate it in the manual and a written form. If we were all standard, there wouldn't be a need to have 30-pages of regional differences for each region, which we do have. I think our company has done a great job of preparing us before we ever fly over there to make sure that we've heard all those terms and that we've been briefed on what to expect, just as if we were in an international ground school.

We have something called the equivalent ATC phraseology for Latin America that is provided by flight operations, flight training, and standards. To use that information helps me understand some of the differences. It is very specific. If you read that, when ATC says "cleared direct," that does not mean you are cleared from present position direct. The controller would have to say "cleared present position direct to fix."

The company is pretty good about putting out little blasts of information — "Hey guys, we're really screwing up in this particular arena, so listen up." When things do fall through the cracks, it seems like there's pretty good follow-up, and usually it's just between us talking at the restaurant, or the debrief, and word of mouth gets around.

Pilot Actions

I have had several occasions of being cleared for a standard terminal arrival, and it becomes ambiguous whether you are cleared to descend via the arrival altitude restrictions or not. Foreign controllers — especially non-native English-speaking controllers — are unsure how to differentiate that specific thing. On the standard departure, you'll have an altitude restriction and they'll clear you directly to an altitude; they don't always mean that you are cleared to disregard the crossing restriction on the climb. So, I've made it a habit that when this happens to read back and make sure I understand the clearance is to climb unrestricted to this altitude. A good percentage of the time they'll come back and say, "No, cross at the altitude that's listed or comply with the restriction," even though the altitude assignment should have removed the restrictions.

When I am cleared direct, it can mean cleared via the flight plan. I always repeat the clearance or ask for clarification to be sure of the intent of that particular controller. I always ask what the controller really wants. "Am I cleared to go direct from here to this point, or do you want me to fly the route to that point?" And they'll come back and say, "Oh no, cleared direct, you go now to this point of the flight." So, I may rephrase it a little bit to get it a little more clear for what's going on, and then we'll get the gist of what they want us to do.

One departure in San Jose has a certain limit altitude, and they'll clear you to 36,000 feet on your

[37] Slang term developed in the military for soldiers who shared a living space. Since they were assigned bunk-beds, "bunkies" was coined.

[38] Refers to some portion of a company manual.

[39] Dogleg is aviation jargon for the type of intercept the pilot makes to join an approach that is other than straight in. It looks like a dog's leg.

clearance; but they also give you the departure, and on the departure it's 4,000 feet. It's a prime example of a questionable clearance, even though they've given you a clearance to 36,000. And if the co-pilot slips 36,000 in the altitude holding on the Mode Control Panel [MCP] and I go, "Did we get MARS One?" then I'll clarify again and once I get there, once you get airborne, they'll tell you, "Remain at 4,000 feet." And then we have 36,000 on the MCP. It's safe if we didn't do that earlier on the ground. So, now you're doing extra work. Experience tells you to clarify that as you're climbing out — Am I or am I not going to stop at 4,000 feet at such and such point? Trust no one; verify everything. It's quick, it's simple and everyone is then on the same page.

OK, I hate to sound like a paranoid individual, but that's what I do on even the simplest of clearances: maintain heading, maintain speed, cleared to a different altitude. Coming out of a European or South American country, I usually have three pilots. I've got everybody in the cockpit on a headset or listening up. If I'm cleared direct, I say, "Am I cleared to go direct from here to this point?" Often, there are more radio transmissions from us to ensure that we're doing what we're expected to do and don't make a mistake.

I don't ever ask for direct in Europe or South America or many other places, because I'm not sure what they're going to expect out of me. If I do get a direct clearance, then I have to make extra effort, too. I'll confirm, "OK, understand present position direct to this point." I won't even ask for a more convenient routing or altitude. I probably won't change anything, because I don't want the unexpected. If I file a flight plan, I'm getting the expected, so chances are better that I won't have anything go wrong.

I think the company and we, unfortunately, fall on our swords in attempting to fix the incongruities. We admit too soon our screw-ups in many areas, when overall we and the company seem to be doing a pretty good job.

Practices or Terms Used by Controllers

Fix Names Versus Airport Names

The controller gives a clearance to a fix which has the same name as the airport. Which one does the controller expect you to proceed to?[40] There's just a few, but it's a question. You know that Lima and Bogota have miles between the airport and the NAVAID. Bogota is different by 7 miles; I think they navigate 7 miles north of the airport. At Lima, they're offset 3 to 4 miles. If you're cleared direct Lima, then is it direct to the airport or direct to the NAVAID? You get the same thing everywhere. Is it the fix or the airport?

ICAO Versus United States Phraseology/Procedures

Every country has its own standardization. So, what do you take from each? Is the United States the answer? Is it the model for all of aviation, or are there some good points in other countries? Should we follow their standards? I have run into this incongruence for over six years. In particular, London — and maybe Tel Aviv — as far as clearances go, they'll give you one clearance: clear you direct. They expect you to do something else other than what you're normally used to here in the States. I don't think I'm really qualified to say what would be the right or wrong use of the phraseology in a clearance. For example, "position and hold" versus "line up and wait," changing altimeters at 1,800 feet, "direct routing" altitude assignment when taken off of departure or arrival procedure, or altitude restrictions being required while still on a SID/STAR with a new altitude assignment. Would that be best for us, or would it be better if we used something from Europe?

In the States, "cleared direct to a certain fix and or altitude" normally means you bypass all the other restrictions that are on the SID. The difference in ICAO phraseology from domestic to international is why we continually have runway incursions as being one of the top hits on our safety list. Then we have, the "line up and wait," versus, "up to and hold short" in the States. The phraseology should be the same. It's such a minor change. ICAO phraseology is not the same as FAA, and I think the FAA should conform to ICAO.

Language

It's my understanding that English is the accepted aviation language worldwide. Unless ICAO penalizes the nations somehow for not complying, there are those that just won't. There might be a subset group of controllers that might be the swing shift that just won't, unless there's going to be some sort of enforcement action. And I think that's what it's going to take, and I'm in favor of it. Because frankly, I've been very frustrated going into some airports and having them repeat the clearance to me because I didn't understand it, and then give it to me in an aggravated tone as if he's saying, "Can't you understand what I'm telling you?" and "I told you that once." The problem is that they don't speak good English. I don't understand a word they say.

To make it clear, we do a lot of phonetic spelling. Our ability to ask questions, whether it's oral or written, is necessary in this business. When you go beyond a routine question because of routing, the language barrier becomes a real problem. When we stay within this small very narrow band of questions that we have, we're always listening for a short reply from the controllers. If we ask a question that's a little more complicated, we'll find out exactly how fluent they are in the language but they are questions we have to ask. So, I found the language barrier to be a problem.

Phraseology

The respondents provided no specific phraseology. Instead, they referred more to the meaning of word(s).

They're cleared direct to a point when, in actuality, ATC wants them to fly the route. Also, I found that internationally, air traffic controllers use phrases that are different from the FAA. They lack the phraseology to clear an aircraft to take the runway; the phraseology should be standardized. There is a definite impact on operations based on understanding the local idioms, such as, "line up and wait" versus "position and hold."

[40] This pertains only to a direct routing clearance.

It's been brought up before — the use of local idioms or phraseology like "line up and wait." The "cleared direct" — what does that mean? Just recently in the States, we had to clear that up. It sounded like the controller was clearing us between two points on the SID, so I'm thinking, here it is I'm speaking to another English speaker, and I go, "What did he mean?" When we go someplace else, we've really got to choose our words carefully. To make it very clear, we do a lot of phonetic spelling of things; we don't want to get cleared direct to "Voogun" or something like that and we've got about three to four fixes with similar pronunciations on our eight pages of legs, things that rhyme with "Voogun." Just spell it out.

In Latin America, you will hear things like, "not cleared for take-off," "not cleared for landing," which you would never hear in this country, of course. But then again, they're translating from Spanish to English and you say, "Are we cleared to land?" They go, "No, you're not cleared to land." Here, you'll hear "negative," or something like that. We ask because we don't want to be misinterpreted as being cleared to land or cleared for take-off. As far as the ATC system goes, it's really non-standard. The Cancun controller uses "si" for "affirmative" or "roger" and "no, no, no" for "negative." If you're not familiar with that, you would absolutely be in huge trouble.

Position Reporting

Position reporting varies in different regions. The written position report formats, MET reports, FIR calls, pre-departure clearance requests, and some controller instructions and route clearances are different from what I expect, and from what experience tells me is desired by ATC.

Written Procedures and Controller Instructions and Expectation

The pilots provided many examples that cite confusion over the meaning of a direct route clearance, which was most often used when the aircraft was on an SID or STAR.

Altitude Assignment

One of the differences in a written rule and controller use is what the U.K. controllers do. They have a very low transition altitude over there. They will frequently clear pilots to the lowest usable flight level (or what we would call an unusable flight level) when the altimeter setting is below standard. They find that to be quite normal and acceptable, whereas the ICAO standard is, to be specific, flight level seven zero is not usable if the altimeter setting is below 1013. Well, you can have an altimeter setting of 992 over there, and they'll clear you to flight level seven zero and expect you to go there. That is a completely local procedure that is different from the ICAO standards.

Going into places like San Salvador and [other places in] Central America, you can use some of that altitude assignment as well. In some cases, there are terrain issues to deal with, and if there are not, they will give direct clearances[41] if you ask for them.

[41] (Without terrain clearance.)

Altitude Restriction

Each example provided by the pilots is a situation in which altitude restriction applies when an aircraft is cleared from an SID or STAR to a direct route.

If you look at the Denna departure in Tel Aviv, you will see it has required altitude crossings, and a little tiny ball note right next to that. Down at the bottom of the page, it says that clearance to climb to a higher altitude does not relieve you of the requirement to cross this fix at this altitude. It's an example of one place in the world where there is an exception to that well established rule. Now it is published on a little ball note in tiny little print which, at my age, you have to get out your glasses to read. Right after flying a Tel Aviv flight, you go up to London and ATC clears you to a higher altitude, and you want to ask, "OK, now am I cleared above that?" But I know that if I ask, he's going to yell at me. So, I use the procedures, and everything's fine. But that's an example for exceptions if they're going to have them, and I'm sure there's a good reason for Tel Aviv. In fact, I know there's a good reason; it's because of military traffic. But mandatory altitude restrictions should be in bold print on the chart if there are exceptions.

Everyone knows that we do what's on this plate.[42] There's a great example of a confusing thing that is put into the Frankfurt guide. I think it's the Mercy 1 Arrival [MRIS-I][43] or something like that. Anyway, it's an arrival that has speeds and altitudes. The first one or two altitudes are expected, which means you just plug it in for descent planning, but then there are no hard altitudes. If you read down on the very bottom of the plate, it says, "clearance for this arrival is routing only," or something like that. One might expect that, "OK, now I'm cleared for this arrival, and here are some hard altitudes." Negative, it's just routing. So, it's just another example of a "got you" that could happen.

Another example has to do with altitudes versus routing, and that is a situation where the clearance to climb supersedes a restriction on the departure. If a departure has a requirement to cross a fix at a certain altitude and a controller gives you a clearance to a higher altitude, you may climb to that higher altitude. Now I'm talking about London. It used to be that they would clear you to a certain altitude; you're cleared to climb to that altitude say, 8,000 feet. But what they really meant was, "Yeah, you're cleared all the way up to 8,000 feet, but you've got to meet all those restrictions." That's something that's part of the SID.

In Tel Aviv, you're cleared a high-speed[44] climb, but you still have to meet the restrictions that are out there, like not exceeding the altitudes that are there. So, you can do the high-speed climb, but you have to meet that 8,000-foot restriction.

We talked about the American Airlines accident in Cali, Columbia, and the routing. Well, the Cali controller also expected him to meet all the

[42] The pilot is possibly referring to the printed procedures or charts used to fly approaches during IRF operations.

[43] (MRIS-1 STAR.)

[44] (Probably means an unrestricted climb.)

intermediate[45] altitude restrictions when cleared to descend, although the route was direct and not on the arrival. One of the causes of the accident was they were cleared direct with no altitude restrictions.[46] In the United States, ATC will give you altitudes that clear the mountains on a direct route. Unfortunately, American ended up in a valley somewhere. What ATC really wanted American to do was fly flight plan routing directly to the airport. That's the way it is in most areas, except places like Europe.

When Beijing controllers clear you up to your cruise altitude, there are these intermediate altitudes that the chart requires you to meet. ATC expects you to meet those restrictions unless you clarify that those restrictions are cancelled. That's not the way it is here in the U.S. or the U.K. In the U.K., ATC will very specifically tell you, "We want you at three one oh, 40 miles south of Trent, flight level three three zero." When he says, "Cleared flight level three three zero," a good thing to do is just ask him, "Does that mean we don't have to meet the restriction in Trent?" As often as not, he will say, "No, you don't." In Asia, that is not the case; ATC expects you to meet that first restriction they gave you, and that's very different from the way it is in the United States.

You know there was an SID procedure that I researched last night in the manuals, the part that gives the [theatre] guide for the U.K. It says, "Maintain these altitudes until you receive clearance from ATC," or something like that. Well, in the States "higher clearance" means if you get an altitude clearance "climb to flight level two two zero" the restrictions are deleted. Does that mean the same thing over there? Well, apparently not. What is the verbiage that clears you and relieves you from that altitude restriction?

I think places like San Jose and Sào Paulo are trying to incorporate some U.S. procedures that we use. If they say "cleared via the SID," then you're good to go via the departure altitudes, or "cleared climb altitude," you're on your own. They'll say, "You're cleared for this arrival," and your chart has all the altitude restrictions, and ATC expects you to do that. If they would all do that, it is cut-and-dried.

The departure out of Mexico City has a 15,000-foot altitude restriction, and they don't say "climb unrestricted." They give you a clearance to climb and it sounds like a clearance to climb unrestricted, but they expect you to maintain that clearance with the altitude restriction.

When cleared to a lower altitude in Australia, you are still expected to meet altitude restrictions on the arrival.

When I'm flying into and out of these places, I need clarification on whether I'm to fly all of the procedure as depicted, or where I am supposed to pick up the remainder. Internationally, cleared to climb to an altitude still requires us to meet intermediate restrictions, while in the U.S. that would not be true.

[45] (probably refers to crossing restrictions and altitudes listed in the arrival).

[46] The pilots' interpretation differs from the information presented in the Columbian DGAC report of that accident. A complete copy of that report can be downloaded from http://sunnyday.mit.edu/accidents/calirep.html.

Diplomatic Clearances

When we are on a diplomatic clearance, we have to get a clearance to cross the border of that country. There are issues with the entry point and the exit point in your clearance across each country, especially in the Middle East. As you get through the smaller countries in Africa and the Middle East, this is the terminology they'll use to your exit point: "You're cleared to the exit point." And that's all they're going to say — "OK, you can fly through our country as you filed." But that's not the way it is in the diplomatic clearance; it says you're cleared to Kasim, which may be the exit point for another country. So, that is a problem with terminology in a lot of the Middle Eastern countries during these operations.

Another issue we have is that if ATC doesn't want to deal with your request, they just don't answer the radio. And you can spend 15 to 20 minutes making a request, or trying to get in contact with them to get a clearance to do something. They just won't answer the radio if it causes them to do extra work. So, if you tell them you're doing something they don't want you to do, they'll answer the radio right now.

Pilot's Discretion Descent

The phrase, "pilot's discretion descent" is not used in some countries. They just don't use those words. I have never heard the words "pilot's discretion" in Japan. I've gotten this a couple of times where ATC says, "[Airline] so-and-so cleared to one six zero, cross {FIX} at one six zero." I'll ask, "Do you want me to start down now?" They always say, "start down now." So it really wasn't pilot's discretion. You'll have to start down now, but still cross that fix at one six zero. OK, if I was in the States, they would say, "Pilot's discretion, cross {FIX} at one six zero." There is some confusion sometimes; do you want it now, or do you want the crossing at our discretion? Be a little bit more specific, or be a lot more specific, actually.

Pre-Departure Clearances

An approach procedure in print can look like it means one thing, but the arrival may mean something different to the approach controller. We're starting to get into the crux of all the communication. There's the verbal that can send me a note on my ACARS,[47] or they can actually put something in print, but things in print don't mean the same thing. Like if you're going into an arrival in London and it ends at Bobbiton, they don't say a word to you. I think they expect you to start holding at the last fix on that arrival. In the U.S., you're looking at a little note that says when you get to the last fix on arrival expect vectors, or it will go from there to usually overhead the airfield.[48] It makes sense to me. On a London chart, you look at it and what you're seeing and how they're communicating to you is not how it's normally understood from the chart. It can look the same and not mean the same thing.

The other example that I would like to cite is, domestically, I'll get a written clearance for departure

[47] Aircraft Communication Addressing and Reporting System.

[48] (Missed approach.)

—a PDC, pre-departure clearance. If I could read and make sense out of the program properly, then down in many of the South American and Central American destinations we go to, a PDC might take us some time to decipher. To make sure we understand, [we will] read back and question and go back and forth before we'll actually understand what we're supposed to do on departure.

There was a limitation in the software that the issuers of the PDC didn't foresee. They didn't program enough space in for long clearances. There are flights now that go 16 to 17 hours. Sometimes the main body of the flight plan exceeds the limitation of the software to print it out. They came out with little notations that meant we had to figure out that flight plan route, or as previously filed, and/or they just have a note. What if all of a sudden I get to a point over the Pacific and the next point on the routing showed the airport of destination, and all the points in between were missing?

Since the PDC was limited by its ability to print out the entire route, the code writers came up with shorthand that was only known to the FAA. That meant the flight plan route after that point was a dot-slash-dot, showing the route was truncated. I find in dealing with a foreign country, questions (written or oral) asked of ATC or ground people should be confined to a small, very narrow band of questions. We ask a question that we're hoping to hear a certain thing coming back from the controller, such as "cleared to a level," "descend to a level," "increase speed," "slow up."

Going into Europe and before going into NATS, if you don't have a clearance, your NATS cards imply that you won't go past ten; it's your final fix. If you're on 10 West, then you automatically go into hold until you get a clearance.

Route Assignment

My biggest pet peeve is that rarely will ATC help if I ask for more convenient routing or better altitudes, so mostly I just fly the flight plan routing. And if I hear "direct" in a non-native English-speaking country, even in England for that matter, it takes me more effort to figure that out. I don't ever ask for direct in Europe or South America or anywhere else, because I'm not sure what they're going to expect out of me, so I won't do it. And then if I get "direct," I have to make extra effort to make sure that I think it is what they want me to do so I'll ask, "OK, understand, present position direct to this point."

When I'm in a foreign country and cleared direct to a fix, it may mean via flight plan route, not present position direct to fix. The clearance "present position direct" is confusing; in many countries it means via flight plan route. Sometimes the controller will use "directly" instead of "direct."

In Guadalajara, it's different again. The controller saying, "turn right to {FIX}" is not a clearance direct to {FIX}, but confirmation to pick up the DME[49] ARC to the outbound radial to {FIX}. Some pre-departure clearances out of some South American cities will clear you on a route, — let's say Whiskey 44; but in reality, we're flying a standard instrument departure.[50] Whiskey 44 just happens to sit underneath the SID that you're flying at that time.

Out of San Jose, Costa Rica, it's the same. They'll clear an aircraft on departure via Alpha Bravo 767. It's their first line of clearance that you're cleared Alpha Bravo 767 and that's what you read, but in reality, you can only pick it up a hundred miles away. The "cleared direct" clearance is an excellent example of confusion about what the controller wants.

In London, when they say cleared "direct," they mean the same thing we mean over here, and that is just go direct to the point. Because you couldn't be cleared beyond a fix — let's say Gatwick — and not beyond, that's where you had to go into hold automatically. Now they give you route direct or direct, and to the point where it's confusing. They interchange the terminology from time to time from what they mean, direct route or direct via route.

The French clear you to the FIR boundary direct, which means right on the filed route. If you went present position direct to that point, it's just waypoints, but your course did not change a bit. You are kind of left in the air, like, "Did they really want present position direct, or did they mean direct via flight plan route?"

In Mexico, when you ask them for a direct route to Cancun, they go "Si, you're cleared direct Cancun." And what that direct means to them is direct along your route of flight. If you say, "Understand Ownship 1 - 2 - 3 is cleared present position direct to Cancun VOR," they'll either say "Si" or they'll say, "No, no, no — you were cleared along Amber 315 to Cancun."

Probably everyone that goes over the same fix is asking the same question about routing, altitude restriction, etc., and that is increasing frequency congestion.

Runway Separation

There is a peculiar procedure that ATC uses in a couple of countries. They clear you to "following the A319, line up and wait," and there are two Airbus airplanes out there. You're looking at two similar-looking planes. They have an engine on each wing, and they're made by the Europeans, but I can't tell an A319 from an A318. The types are not totally familiar to me. ATC will clear it up, [but if] there are setups out there like that where you're going, you better watch out.

England is an excellent example that uses "line and wait."[51] They'll taxi you into your position so they can say, "After landing the 747, line up and wait for runway Humptycratts." And the 747 that they're talking about is just now going past me — I can see the wheels coming down — and they expect us to come out underneath and basically get into his wash as it sinks onto the runway, so that the minute his last piece of aluminum clears the runway, we're rolling down the runway. You have to read the scene that you're given. You can look, read it and assess the situation, but the minute you see it in operation,

[49] Distance Measuring Equipment.

[50] The SID and airway overlay each other.

[51] Implied loss of separation by clearance - resolved by Tower.

[you think] "Wait a minute, why are we moving?" They would never do that in the States. Clearly, as you know, they would never issue the clearance like that. Overshoot, for me, means "go around." [52] These types of things don't seem to follow the written procedure. In Europe and according to ICAO, you get the words "hold in position" that tells us "cleared into position and hold," when that's not the case. We're cleared to the runway, but not onto the runway. A clearance to "hold position, runway x" sets another trap.

DISCUSSION

International Flight Experiences Among Participants

In the three months preceding the interviews, the 48 U.S. pilots listed 74 geographical areas they had flown through, with Canada, England and Mexico frequented by at least 33% of the pilots. They landed their aircraft in 47 different countries or regions during that time period. Within the 30 days preceding the interviews, 83% of the pilots flew an average of five international flights, including multiple flights to Costa Rica, Guatemala, and Venezuela. Clearly, as a group, the pilots had diverse flight experiences.

English Language Acquisition and Usage

All U.S. pilots listed English as their first language and noted they had learned to speak it informally at home prior to entering elementary school. Also, they reported English as the language spoken most frequently at home. Approximately 60% reported they neither spoke nor understood any languages other than English. For the remaining pilots, many indicated they spoke/understood some French, Spanish, or both. In addition to Spanish, one pilot also spoke/understood German, and one spoke/understood Spanish, French, and Portuguese. When asked about their listening and speaking skills, nearly 80% of the pilots reported no dominance of one skill over the other.

Communications Modality Preferences

Ground-to-Air Communication

When asked about their preference regarding mode of communication, 33% of the pilots preferred to hear ATC messages, 54% preferred to read them, and 13% had no preference. Among the reasons given for preferring to hear messages spoken by controllers, pilots cited spoken communication as easier, faster, more familiar, and provided more situational awareness because they could listen to the inflection and cadence in speech, as well as allowing for multitasking without being "heads-down."

For pilots who preferred to read ATC messages, they reported foreign accents, pronunciation, and other linguistic factors that impeded understanding while poor equipment and message reception degraded the intelligibility of communications. One of the benefits cited was the belief that reading ATC messages would prevent misunderstandings because messages in text format are clear, more direct, and clearances can be confirmed visually.

Air-to-Ground Communications

Approximately 71% of the pilots preferred to speak their messages to ATC. They thought speaking was much faster, easier, efficient, and familiar. They also noted that poor typing skills, coupled with being "heads-down," redirects the pilot's focus away from aircraft control and removes the pilot from flying the aircraft.

The U.S. pilots who preferred to type their messages to ATC suggested that text messages significantly decrease hearback/readback problems and miscommunications due to translation problems, thereby reducing miscommunications. With fewer errors, more time is available for inter-crew communications.

Bilingual Crewmember as Translator for International Communications

Approximately 25% of the pilots said having a crewmember who could translate non-English transmissions could reduce communication problems. Likewise, it would be helpful for immediate clarifications and situational awareness. However, the majority of the pilots disagreed, primarily because ATC transmissions could not be cross-checked and verified by all crewmembers.

General/Pre-Flight Preparation

When the questions focused on preparing for international flights, the themes that predominated the discussions were communication, crew experience, procedures, routing information, and weather information. The pilots looked to the Jeppesen and company charts and plates, flight plans, and weather provided by television and the Internet in preparation for their scheduled flights. Several pilots mentioned security, using Internet, newspaper, and television news to determine possible unrest in the countries they were flying over or into.

The pilots also spent time looking up and studying the names of the fixes, NAVAIDS, etc., as well as typical phrases they would likely hear and may have to repeat to facilitate understanding. They imagined how those utterances might sound when spoken by non-native English-speaking controllers and radio operators. They studied the procedures that apply to the foreign airspaces they will be going through, examined what potential problems could affect the flight, and looked to weather information. Potential volcanic activity, typhoons, hurricanes, and other weather events can close down corridors and countries (e.g., Bermuda). When laying-over in non-native English-speaking countries, pilots have access to local news media, but weather information may be available only in the local language. Because many of the pilots noted they were not bilingual, they would be

[52] Overshoot may mean to land over an aircraft entering the runway.

at a disadvantage in understanding the weather implications on upcoming flights.

The pilots also said that they found out who the other crewmembers were for the flight to determine their familiarity with where they are going, as well as to assess the crew's strengths and weaknesses. Although much can be learned reviewing both airline and Jeppesen charts and plates, reviewing the flight plan, checking out different sources of weather information, and asking those with previous knowledge of the area provides them with other types of information not available on paper or in the simulator. Pilots use all the information sources available — graphic, textual, and experiential — to develop a mental representation and foster a deeper understanding of what to expect during an actual flight. They build contingencies, or "work-arounds," as necessary to preserve passenger safety and comfort.

Anticipated and Experienced Language Difficulties

When pilots were asked of the language difficulties they experienced, the controllers' poor English language comprehension and production skills and their inability to communicate in plain language accounted for 56% of the problems pilots listed. Pilots discussed their reliance upon the VHF radio for air-to-air communications with other pilots to gather weather and turbulence information by asking pilots about ride reports. Although the information might be dated, it was better than nothing. With the lack of radar and radio coverage in some parts of the world, pilots had to broadcast their locations and intended maneuvers as a means of providing self-separation from other aircraft in the vicinity.

Of notable concern was that some controllers were unable to answer basic aviation questions asked of them by pilots. Often, controllers would simply repeat the transmission over again, say "roger," or not answer at all. Some controllers thought by speaking quickly, they were more proficient than when speaking at a slower rate. Yet, others would ask their local pilots to translate information from the local language into English. As long as communication follows ICAO standards and nothing unusual occurs, problems with language skills are concealed.

Likewise, there are differences in the inflection, dialect, accents, cadence, and other prosodic and linguistic features[53] that distinguish the production of English geographically. Accents tend to be a problem for most pilots, even among native English speakers. These are but several characteristics of an oral language that can affect the pilot's ability to accurately decode message streams and parse their contents into something comprehensible. Pilots should never have to rely on prior experiences, expectations, or contingencies to determine the name of a fix, intersection, waypoint, or number, nor should they have to second-guess the contents of a clearance.

In painting the picture of the language difficulties U.S. pilots encountered, non-standard terms for standard operations added to the complexity of flying and often contributed to miscommunications. Pilots provided several examples, some well-known (e.g., "line up and wait") and some more obscure (e.g., "on the same position," or "how many miles to run"). There were also many of the same terms used differently based on location (e.g., "cleared direct" in the U.S. does not carry the same meaning internationally).

It is important for pilots to be aware that cultural differences can affect safety. The example most often cited in the interviews was the Cali accident. The lessons-learned from that accident and from other pilots' experiences is that some controllers providing ATC services outside the U.S. believe pilots will not accept an unsafe clearance. Novice pilots need to know that controllers are not a safety net—if pilots ask for something, the controllers are likely to give it to them. The onus is on the pilots to be sure of their position.

Unlike the FAA, which uses only English for pilot-controller communication, when pilots fly outside the U.S., it is common to hear multiple languages on a frequency. Although speaking in the native language may be advantageous to local pilots and controllers who speak and understand that language, it does create language-induced gaps in situational awareness among the rest of the pilots flying in range of the transmitter. The pilots do not know whether the controller is giving a clearance, an altitude change, or talking about the outcome of a recent soccer match. What the pilots do know is that they are affected adversely, because they are in the same airspace as the other aircraft, but do not know what is happening.

ATC Procedural Complexities Affects on Flight Experiences

The pilots gave no examples of complex procedures, nor did they identify any by name, which may have been due to the lack of a clear definition of complex procedure. The pilot may consider complexity largely a matter of the traffic situation. When asked about how ATC procedural complexities affected their flight experiences, the responses given were based on the individual perspectives. About 10% reported that the complexities allowed them to develop their piloting skills and grow professionally. They also felt they were given more latitude and control over their flights by controllers; flying became more a collaborative action between the pilot and controller.

Other pilots reported it depended upon a pilot's prior flight experiences. A new captain or crew may experience more problems than a seasoned pilot who is more familiar with a certain route. Likewise, seasoned pilots know that some countries have very specific rules pertaining to altitudes and altitude restrictions, altimetry settings, and communication procedures. They also know there is a

[53] Listeners of U.S. English can detect the end of an utterance from intonation shifts at the end of the final word in the sentence followed by longer pause duration. Generally, pauses of shorter durations occur at the end of a clause rather than at the end of a sentence.

lack of standardization in airport and oceanic procedures, and that the terminology used to deliver information is not universal. A seasoned pilot knows that some controllers are better at giving hand-offs than others and plans accordingly.

Although new pilots can spend a lot of time researching, reading, and studying various charts, plates, and flying simulators to gain familiarity with a new route, the best training aid of all is a pilot experienced with the flight area. There is a difference between expectations and reality. Although the procedures say one thing, in reality, it may be completely different, depending upon the route to be flown and whether or not there is radar coverage and working radios. Only someone who has been there knows what to expect and can share that knowledge with someone unfamiliar with the route.

Notable Procedural Differences Between the North Atlantic Track System, Western Atlantic Route System, and Asia-Pacific Regions

Pilots spent a considerable amount of time discussing the complexities of the NATS as compared with the WATRS and Asian-Pacific regions. Notably, the NATS was thought to be more complex and more challenging than the Asian-Pacific or WATRS regions, primarily because the NATS is inflexible, procedurally more demanding of crews, and has considerably more traffic. More traffic resulted in radio congestion with the HF frequencies shared globally.

Pilots also raised specific issues that addressed some of the complexities related to international flights that U.S. local pilots do not experience. In particular, they called for global standardization to make operations safer. They noted when flying internationally, pilots must be cognitively alert to changes that occur when transitioning altitudes, with a heightened awareness to changing their settings on the altimeters from millibars to inches and from feet to meters. Because there is no universal standard, pilots must be vigilant in asking controllers what is meant by "cleared direct."

Although many pilots who use datalink advocate its use, they also note technology does make flying easier, it is not always accessible. Likewise, the lack of radar, weather, and VHF coverage make flying difficult, especially when combined with problems in language proficiency and cultural differences. These problems manifest themselves when abnormal events occur and non-routine communications related to flight operations are necessary.

Differences in ATC Procedure Implementation or Interpretation Between International and U.S. Airports

Almost 90% of the pilots reported their performance was impacted to a limited or greater extent by differences in ATC procedural implementation or interpretation between international and U.S. airports. There were no specific examples of any procedures in the United States that differ internationally, but there was mention of the route clearance "direct" by several pilots. The comments concerning "direct" routing generally related to "south of here," not a specific facility. The statement most often used to indicate a belief of differences in U.S. and international operations was "the U.S. does not use ICAO procedures or phraseology." The three most prevalent examples were "direct route," "line up and wait," and "miles to run."

Pilots cited the manner in which clearances and procedures were interpreted (i.e., the pilot and controller may have different interpretations to the meaning of "direct"), culture (e.g., in South America, it is directed from the cockpit to the ground and in the U.S. and Europe, it's more directed from the ground to the cockpit), language comprehension and production (e.g., in addition to being able to understand different dialects, accents, and the like were issues dealing with ICAO terminology that is not consistent throughout the world), and workload (e.g., the number of times the pilot must talk to controllers varies from country to country) as the factors influencing their performance.

Differences Between U.S. and ICAO Procedures

Two central themes emerged from their discussions. One provides examples where the same phraseology is used by different countries to support the execution of a different procedure than what the pilot is most familiar (e.g., "cleared direct"), and the other provides examples of how different phraseology is used to support the same procedure. Both demonstrate the need for global standardization.

To this question, pilots brought forward the issue of phraseology and procedural differences between the ICAO and the U.S. They also mentioned each country has its own standardization. Because of the differences in the interpretation and execution of the "cleared direct" procedure and others, the airline companies often provided their pilots with timely information in posted bulletins that gradually became incorporated into their manuals. Pilots also talked among themselves and shared information from their recent flights. Both approaches provided pilots with methods for dealing with incongruities. Many pilots discussed the interpretation of altitude and crossing restrictions, as well as the "cleared direct" procedure as being especially problematic.

Finally, deficiency in English language proficiency was discussed as an impediment of effective communication and flight operations. In particular, when communications went beyond routine questions or standard operations, the language barrier became immediately apparent. Pronunciation was a key factor that impeded the intelligibility of an utterance.

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APPENDIX A

Interview Questions

First of all, we want to thank you for agreeing to participate in this interview and answer questions about your international flight experiences. We know you are busy and we appreciate your willingness to give up some of your free time to come here today. In preparation for the interview, we need to gather some basic background information relevant to your flight time.

General Background Information

1. In what country did you train to become a pilot? _____
2. How many years have you been flying international routes? _____
3. Which countries' airspace have you flown through in the past three (3) months? _____

   _____
4. Which countries' airports have you landed at in the past three (3) months? _____

   _____
5. How many international flights have you made in the past 30 days? _____
6. Where did you fly to in the past 30 days? _____

   _____

English Language Usage

7. What is the first (primary) language that you learned to speak? _____
8. What is the first language you learned to speak **fluently**? _____
9. What is the language that you speak most frequently when at home? _____
10. How old were you when you learned to speak the English language? (Circle one)
    - As a preschooler (under the age of 6)
    - As a child (6 - 12 years old)
    - As an adolescent (13 - 18 years old)
    - As a young adult (19 - 25 years old)
    - As an adult (26 years or older)
11. Where did you learn the English language? (Circle one)
    - It was taught informally in the home
    - It was taught informally by friends
    - It was taught formally as a second language in public school
    - It was taught formally as a second language at the university
    - It was taught formally at a private language institute
12. Do you speak English as a second language? _____
13. Other than English, what languages do you speak or understand that are broadcast over your communications equipment?

    _____

    _____

14. When communicating with controllers in English, would you prefer to hear or read their messages? (Circle one)

    Strongly prefer to hear

    Prefer to hear

    No preference

    Prefer to read

    Strongly prefer to read

    Please explain. _____

    _____

    _____

15. When flying into a country where you do not speak the language, would you want a cockpit crewmember who could speak the language communicating with ATC?

    Please explain. _____

    _____

    _____

16. When responding to controllers in English, would you prefer to speak or type your messages? (Circle one)

    Strongly prefer to speak

    Prefer to speak

    No preference

    Prefer to type

    Strongly prefer to type

    Please explain. _____

    _____

    _____

17. How would you describe your English language listening and speaking skills? (Circle one)

    My listening skills are much stronger than my speaking skills.

    My listening skills are stronger than my speaking skills.

    My listening skills are equal to my speaking skills.

    My speaking skills are stronger than my listening skills.

    My speaking skills are much stronger than my listening skills.

    Please explain. _____

    _____

    _____

General Questions

In preparation for the following questions, we would like you to think about your experiences flying in domestic and international airspace. Sometimes you hear native speakers of English (NS) who grew up in an English-speaking family, and at other times you hear pilots and controllers who are non-native speakers of English (NNS) but learned it as a second or third language. Although English is the international language for aviation, we know it is common for pilots to hear other languages being spoken over their communications system. You might be flying through Africa, Asia, Europe, North America, Oceania, or South America and encounter a language that is not your first language. Think about situations you have experienced where language issues became a barrier to efficient and effective communication between you and air traffic control when responding to the questions.

Pre Flight Preparation

18. What do you do to familiarize yourself for international flights as compared with domestic flights?

_____

_____

_____

a. List the sources of aviation information you use to prepare for international flights.

i. _____

ii. _____

iii. _____

b. What are some language difficulties you anticipate (or have experienced) when flying in international airspace?

i. _____

ii. _____

iii. _____

Air Traffic Control (ATC) Procedures

19. Air traffic control procedures vary from country to country. What effect has the difference in ATC procedural complexities had on your flight experiences? (Circle one)

Very positive

Positive

Neutral

Negative

Very negative

20. To what extent has the difference in ATC procedural complexities influenced your flight experiences? (Circle one)

To a great extent

To a considerable extent

To a moderate extent

To a limited extent

Not at all

21. How would you describe the differences in ATC procedural complexities between international sectors and airports? For example, what differences do you think are notable between the North Atlantic Track System, the Western Atlantic Route System (WATRS) region, or the Asia-Pacific region?

Please explain. _____

_____

22. To what extent is your performance impacted by different ATC procedure implementation or interpretation between international and U.S. airports? (Circle one)

    To a great extent

    To a considerable extent

    To a moderate extent

    To a limited extent

    Not at all

    Please explain. _____

    _____

    _____

23. Is there any incongruence between what you would normally understand is written (on a procedure) and what the controller instructs or expects you to do during a flight? For example, some controllers in some countries believe that a “Cleared Direct” instruction means that the pilot is expected to fly the currently filed track over the named waypoints “directly” to the airfield. Other controllers in the same country expect a pilot receiving a “Cleared Direct” instruction to deviate from the previous route clearance and to fly on a straight track between his present position and the point mentioned to which he has been cleared.

    Please explain. _____

    _____

    _____

Word Meaning and Pronunciation (how words are spoken)

24. How often during a flight do you experience problems related to word meanings? (Circle one)

    Rarely (less than 10% of my interactions with controllers)

    Occasionally (between 10-24% of my interactions with controllers)

    Frequently (between 25-74% of my interactions with controllers)

    Often (between 75-90% of my interactions with controllers)

    Without fail (more than 90% of my interactions with controllers)

25. How often during a flight do you experience problems related to how words are pronounced? (Circle one)

    Rarely (less than 10% of my interactions with controllers)

    Occasionally (between 10-24% of my interactions with controllers)

    Frequently (between 25-74% of my interactions with controllers)

    Often (between 75-90% of my interactions with controllers)

    Without fail (more than 90% of my interactions with controllers)

26. What problems affect you most related to differences in the word(s) used to describe a clearance, instruction, advisory, or request? Please list some examples.

    a. _____

    b. _____

    c. _____

27. There are problems related to the same word(s) used to describe different actions. Just to get you thinking, consider the difference between “hold point” used in the air versus “hold point” used on the ground or “taxi into position and hold” versus ”line up and wait.” Can you think of any other examples where the words themselves have caused confusion? Please list a few.

    a. _____

    b. _____

    c. _____

28. Have you experienced problems related to how words are pronounced (e.g., accents or dialects)? Please explain.

_____

_____

_____

a. Which words are more difficult for you to understand? _____

_____

_____

b. Do you perceive a difference in clarity of information provided when a **native English speaker** uses “Indian English” versus “Hong Kong English” versus “British English” versus “North American English?”

_____

_____

_____

c. Do you perceive a difference in clarity of information provided when a **non-native English-speaker** uses “Indian English” versus “Hong Kong English” versus “British English” versus "North American English?”

_____

_____

_____

29. To what extent have you found non-standard terminology confusing? (Circle one)

To a great extent

To a considerable extent

To a moderate extent

To a limited extent

Not at all

Please explain. _____

_____

_____

30. To what extent do you experience language-related difficulties when programming the FMS to comply with ATC? (Circle one)

To a great extent

To a considerable extent

To a moderate extent

To a limited extent

Not at all

Please explain. _____

_____

_____

FOR THIS PART OF THE INTERVIEW, SPECIFIC COMBINATIONS OF PILOT/CONTROLLER LANGUAGE USEAGE SITUATIONS ARE PRESENTED.

Think about your flight experiences when approaching (or flying through) South America, Central America, Asia, the Middle East, and other parts of the world where English is not the native language spoken by pilots and air traffic controllers. The questions in this section of the interview focus on how hearing other languages over your communications system affects safety, your situational awareness, and communication between you and air traffic control.

Language Experiences in Non-Native English-speaking Airspace/Airports

Imagine flying where Chinese, Hindi, Spanish, French, or a language other than English is the primary language in that country/province/state. Citizens who wish to become air traffic controllers must learn English because it is the required, official language of aviation. However, a controller may speak the primary language of their country to pilots who also speak that language and switch to English when speaking to pilots from another country. You may hear several different languages on a frequency.

31. List the different non-native English languages you typically hear over your communications system during international flights.

_____

_____

_____

32. How would you rate your overall non-native English-speaking language experiences during these flights? (Circle one)

    Very positive

    Positive

    Neutral

    Negative

    Very negative

33. How is your workload affected by your experience with non-native English-speaking language differences during a flight?

_____

_____

_____

34. How often do you experience communication problems in non-native English-speaking airspace/airports? (Circle one)

    Rarely (less than 10% of my interactions with controllers)

    Occasionally (between 10-24% of my interactions with controllers)

    Frequently (between 25-74% of my interactions with controllers)

    Often (between 75-90% of my interactions with controllers)

    Without fail (more than 90% of my interactions with controllers)

35. Of the non-native English-speaking airports that you fly into, do you find the English language skills of other pilots and controllers comparable from one country to that of another? Please explain.

_____

_____

_____

    a. Do you find that that the intelligibility of some non-native English-speaking controllers causes you to work harder to understand them? (Think Montreal versus Katmandu or Johannesburg versus Dakar.) Use any other examples that you may care to.

        i. _____

        ii. _____

b. What makes some non-native English-speaking controllers' speech more difficult than others to understand? (e.g., speech rate, pronunciation)

i. _____

ii. _____

iii. _____

36. When flying in a non-native English-speaking country, how often do controllers use ICAO standard phraseologies for routine communications to speak to you? (Circle one)

Without fail (more than 90% of my interactions with controllers)

Often (between 75-90% of my interactions with controllers)

Frequently (between 25-74% of my interactions with controllers)

Occasionally (between 10-24% of my interactions with controllers)

Rarely (less than 10% of my interactions with controllers)

37. When flying in a non-native English-speaking country, how often do controllers use Common English for routine communications to speak to you? (Circle one)

Without fail (more than 90% of my interactions with controllers)

Often (between 75-90% of my interactions with controllers)

Frequently (between 25-74% of my interactions with controllers)

Occasionally (between 10-24% of my interactions with controllers)

Rarely (less than 10% of my interactions with controllers)

Please explain. _____

_____

_____

38. When flying in a non-native English-speaking country, how would you describe the controllers' ability to communicate with you in Common English? (Circle one)

Their communication skills are excellent

Their communication skills are good

Their communications skills are only fair

Their communication skills are poor

Their communication skills are terrible

Please explain. _____

_____

_____

a. In general, how much attention is required for you to understand what a non-native English-speaking controller is saying in English? (Circle one)

A great amount

A considerable amount

A moderate amount

A limited amount

It is effortless

Please explain. _____

_____

b. What are the most troubling language-based problems you experienced with non-native English-speaking controllers?

i. _____

ii. _____

iii. _____

c. How often have you heard non-native English-speaking controllers use jargon or slang that was difficult to interpret? (Circle one)

Rarely (less than 10% of my time monitoring pilot/control communication)

Occasionally (between 10-24% of my time monitoring pilot/control communication)

Frequently (between 25-74% of my time monitoring pilot/control communication)

Often (between 75-90% of my time monitoring pilot/control communication)

Without fail (more than 90% of my time monitoring pilot/control communication)

i. Please write some examples of the jargon that was difficult to interpret.

1. _____

2. _____

3. _____

ii. Please write some examples of the slang that was difficult to interpret.

1. _____

2. _____

3. _____

Non-native English-speaking Controllers Communicating With Native English-speaking Pilots

The questions in this section of the interview focus on English language proficiency of non-native English-speaking controllers and how well they communicate with pilots who are native speakers of English. For example, a Mexican controller might speak in Spanish to Aero México pilots and speak in English to pilots flying for British Airways and Baltic International. It is common for you to hear and participate in operational communications over your communications system during international flights. We will explore how these communication exchanges affect safety, the communication process, and your situational awareness.

39. How would you characterize voice communications between international non-native English-speaking controllers and native English-speaking pilots? (Circle one)

Excellent

Very good in most respects

Could use some minor changes

Not good enough for extreme conditions

Extremely poor

Please explain. _____

_____

_____

a. When you hear international non-native English-speaking controllers, what tells you whether they are high or low in English language proficiency?

_____

_____

_____

b. If you suspect an international non-native English-speaking controller's English language proficiency is low, what do you do to improve understanding?

i. _____

ii. _____

_____

iii. _____

_____

40. How might native English-speaking pilots' communications with international non-native English-speaking controllers differ from that of pilots and controllers who speak the same language?

_____

_____

_____

41. During a typical international flight, about how much time do native English-speaking pilots and international non-native English-speaking controllers spend talking as compared with pilots and controllers who speak the same language? (Circle one)

Considerably more time

More time

About the same

Less time

Considerably less time

Please explain _____

_____

_____

42. Do international non-native English-speaking controllers have to communicate differently with native English-speaking pilots than pilots who speak their local (native) language?

Please explain. _____

_____

_____

43. To what extent has hearing a non-native English-speaking controller switch between languages posed a problem for you? (Circle one)

To a great extent

To a considerable extent

To a moderate extent

To a limited extent

Not at all

Please explain. _____

_____

_____

44. Describe how your situational awareness is affected by changes in your ability to understand the language(s) being spoken over your communications system.

_____

a. When do changes in your ability to understand the language(s) being spoken over your communications system most affect your situation awareness? (Assign a “1” to the task most affected, a “2” to the second most affected, etc. Assign a different number to each task.)

_____ When preparing for departure - aircraft is stationary.

_____ When moving in the gate, ramp, or parking area - assisted by a tow vehicle (tug) moving to the taxiway.

_____ When taxiing - the aircraft is moving under its own power and terminates upon reaching the runway.

_____ When preparing for take-off - aircraft is on the runway surface in take-off position.

_____ When take-off power is applied, through rotation and to an altitude of 35 feet above the runway elevation or gear-up selection, whichever comes first.

_____ When in climb to cruise - from completion of initial climb to initial assigned cruise altitude.

_____ When in the en route phase under the control of en route centers.

_____ When in the en route phase in international airspace.

_____ When preparing for descent - from cruse to either initial approach fix or VFR pattern entry.

_____ When preparing for final approach - from the final approach fix to the beginning of the landing flare.

_____ When preparing for landing - transition from nose-low to nose-up attitude just before landing touchdown.

_____ When taxiing - the aircraft has exited the landing runway moving to the gate, ramp, or parking area.

Please explain. _____

_____

45. What do you do to compensate for any reduction in situational awareness?

_____

_____

_____

Language Experiences in Native English-Speaking Airspace/Airports

As you know, English is the dominant language of the United Kingdom, the United States, Canada, the Republic of Ireland, Australia, New Zealand, and a number of other countries and it is spoken in many different dialects. An estimated 300-400 million people speak English as their first language. Presently, it is extensively used as a second language and is the most widely taught and understood language in the world. One recent estimate is that 1.9 billion people, nearly a third of the world's population, have a basic proficiency in English.

For this section of the interview, think about your flight experiences flying into countries where English is the dominant or official language of the country (e.g., Liberia, Hong Kong, South Africa, India, and so on) and what it was like hearing different dialects of the English language spoken by pilots and air traffic controllers. The questions in this section of the interview focus on how hearing other dialects of the English language over your communications system affect safety and communication between you and air traffic control.

46. List the different native English languages you typically hear over your communications system during international flights. (e.g., North American English, Australian English, British English, Hong Kong English, Indian English)

_____

_____

_____

47. How would you rate your overall native English-speaking language experiences during these flights? (Circle one)

    Very positive

    Positive

    Neutral

    Negative

    Very negative

48. How is your workload affected by your experience with native English-speaking language differences during a flight?

_____

_____

_____

49. How often do you experience communication problems in native English-speaking airspace/airports? (Circle one)

    Rarely (less than 10% of my interactions with controllers)

    Occasionally (between 10-24% of my interactions with controllers)

    Frequently (between 25-74% of my interactions with controllers)

    Often (between 75-90% of my interactions with controllers)

    Without fail (more than 90% of my interactions with controllers)

50. Of the native English-speaking airports that you fly to, do you find the English language skills of other pilots and controllers comparable? Please explain.

_____

_____

_____

    a. Do you find that that the intelligibility of some native English-speaking controllers speech causes you to work harder to understand them? Use any other examples that you may care to. (e.g., Indian English, Hong Kong English, British English, North American English; U.S. regions where you might hear Mid-Atlantic English, North Central American English, Pacific Northwest English, Southern American English)

        i. _____

        ii. _____

        iii. _____

b. What makes some international native English-speaking controllers' speech more difficult to understand than others? (e.g., speech rate, pronunciation)

i. _____

ii. _____

iii. _____

51. When flying in a native English-speaking country, how often do controllers use ICAO standard phraseologies for routine communications to speak to you? (Circle one)

Without fail (more than 90% of my interactions with controllers)

Often (between 75-90% of my interactions with controllers)

Frequently (between 25-74% of my interactions with controllers)

Occasionally (between 10-24% of my interactions with controllers)

Rarely (less than 10% of my interactions with controllers)

52. When flying in a native English-speaking country, how often do controllers use Common English for routine communications to speak to you? (Circle one)

Without fail (more than 90% of my interactions with controllers)

Often (between 75-90% of my interactions with controllers)

Frequently (between 25-74% of my interactions with controllers)

Occasionally (between 10-24% of my interactions with controllers)

Rarely (less than 10% of my interactions with controllers)

Please explain. _____

_____

_____

53. When flying in a native English-speaking country, how would you describe the controllers' ability to communicate with you in Common English? (Circle one)

Their communication skills are excellent

Their communication skills are good

Their communications skills are only fair

Their communication skills are poor

Their communication skills are terrible

Please explain. _____

_____

_____

a. In general, how much attention do you have to use to make sense of what the native English-speaking controller is saying? (Circle one)

A great amount

A considerable amount

A moderate amount

A limited amount

It is effortless

Please explain. _____

_____

b. What are the most troubling language-based problems you experience with native English-speaking controllers?

i. _____

ii. _____

iii. _____

c. How often have you heard native English-speaking controllers use jargon or slang that was difficult to interpret? (Circle one)

Rarely (less than 10% of my time monitoring pilot/control communication)

Occasionally (between 10-24% of my time monitoring pilot/control communication)

Frequently (between 25-74% of my time monitoring pilot/control communication)

Often (between 75-90% of my time monitoring pilot/control communication)

Without fail (more than 90% of my time monitoring pilot/control communication)

i. Please write some examples of the jargon that was difficult to interpret.

1. _____

2. _____

3. _____

ii. Please write some examples of the slang that was difficult to interpret.

1. _____

2. _____

3. _____

Native English-Speaking Controllers Communicating with Non-Native English-Speaking Pilots

The questions in this section of the interview focus on English language proficiency of non-native English-speaking pilots and how well they communicate with controllers who are native speakers of English. For example, U.S. controllers speak in English to all pilots regardless of their country of origin. It is common for you to hear non-native English-speaking pilots communicate in English to controllers when they are outside of their country/state during international flights. We will explore how these communication exchanges affect safety, the communication process, and your situational awareness.

54. How would you characterize voice communications between international native English-speaking controllers and non-native English-speaking pilots? (Circle one)

Excellent

Very good in most respects

Could use some minor changes

Not good enough for extreme conditions

Extremely poor

Please explain. _____

_____

_____

a. When you hear international non-native English-speaking pilots, what tells you whether they are high or low in English language proficiency?

_____

_____

_____

b. With regard to communication tasks, what do you do when a non-native English-speaking pilot and you are on the same flight path and you suspect that pilot is low in English language proficiency skills?

i. _____

ii. _____

_____

iii. _____

_____

55. How might non-native English-speaking pilots' communications with international native English-speaking controllers differ from that of pilots and controllers who speak English?

_____

_____

_____

56. During a typical international flight, about how much time do non-native English-speaking pilots and international native English-speaking controllers spend talking as compared with pilots and controllers who speak English? (Circle one)

Considerably more time

More time

About the same

Less time

Considerably less time

Please explain _____

_____

_____

57. Do international native English-speaking controllers have to communicate differently with non-native English-speaking pilots than with native English-speaking pilots?

Please explain. _____

_____

_____

58. Describe how your situational awareness is affected when you suspect that non-native English-speaking pilots are experiencing difficulty understanding international English-speaking controllers.

_____

_____

a. When is your situation awareness most affected by language difficulties between non-native English-speaking pilots and English-speaking controllers? (Assign a "1" to the task most affected, a "2" to the second most affected, etc. Assign a different number to each task.)

_____ When preparing for departure - aircraft is stationary.

_____ When moving in the gate, ramp, or parking area - assisted by a tow vehicle (tug) moving to the taxiway.

_____ When taxiing - the aircraft is moving under its own power and terminates upon reaching the runway.

_____ When preparing for take-off - aircraft is on the runway surface in take-off position.

_____ When take-off power is applied, through rotation and to an altitude of 35 feet above the runway elevation or gear-up selection, whichever comes first.

_____ When in climb to cruise - from completion of initial climb to initial assigned cruise altitude.

_____ When in the en route phase under the control of en route centers.

_____ When in the en route phase in international airspace.

_____ When preparing for descent - from cruse to either initial approach fix or VFR pattern entry.

_____ When preparing for final approach - from the final approach fix to the beginning of the landing flare.

_____ When preparing for landing - transition from nose-low to nose-up attitude just before landing touchdown.

_____ When taxiing - the aircraft has exited the landing runway moving to the gate, ramp, or parking area.

Please explain. _____

_____

_____

59. What do you do to compensate for any reduction in situational awareness?

_____

_____

_____

Communication Problems

60. How often do you hear communication problems between native English-speaking pilots compared with pilots and controllers who speak the same language? (Circle one)

Rarely (less than 10% of my time monitoring pilot/control communication)

Occasionally (between 10-24% of my time monitoring pilot/control communication)

Frequently (between 25-74% of my time monitoring pilot/control communication)

Often (between 75-90% of my time monitoring pilot/control communication)

Without fail (more than 90% of my time monitoring pilot/control communication)

Please explain _____

_____

_____

a. Who typically detects the problem - the pilot or controller?

i. _____

ii. _____

iii. _____

b. When you hear these communications problems, how are they resolved (ICAO standard phraseology, Common English, or both)?

i. _____

ii. _____

iii. _____

61. Based on your international and domestic flight experience, are the communication problems that you have either heard or experienced universal or particular to a region or controlling authority?

_____

_____

_____

62. What ATC messages seem to be problems for non-native English-speaking pilots as compared with native English-speaking pilots?

_____

_____

_____

Technological Intervention

63. If technology could be developed to help remove the language barrier between controllers and pilots what would it do? You might consider a Controller Pilot Datalink Communications (CPDLC, FANS) capability, or any other technology that you can think of in your deliberations.

_____

_____

_____

a. How would you want it to work?

i. _____

ii. _____

iii. _____

b. How might information be presented to you?

i. _____

ii. _____

iii. _____

c. What type(s) of information would you want?

i. _____

ii. _____

iii. _____

64. If technology could be developed to help compensate for any reduction in situational awareness, what would it do? You might consider an Automatic Dependent Surveillance-Broadcast (ADS-B), Cockpit Display of Traffic Information (CDTI), or any other technology that you can think of in your deliberations.

_____

_____

_____

a. How would you want it to work?

i. _____

ii. _____

iii. _____

b. How might information be presented to you?

i. _____

ii. _____

iii. _____

c. What type(s) of information would you want?

i. _____

ii. _____