Aviation English Research Project:

Data analysis findings and best practice recommendations

An independent research report commissioned by CAA

Author: Dr Barbara Clark, You Say Tomato

http://www.you-say-tomato.com

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Gatwick Airport South,

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Author: Dr Barbara Clark
You Say Tomato
barb@you-say-tomato.com

Enquiries regarding the content of this publication should be addressed to: infoservices@caa.co.uk

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Glossary

NOTE: On 1 Oct 2012 the MOR (incident reporting) database system was changed to be compatible with the European ECCAIRS format and the use of MOR terminology in this report is just used for simplicity, regardless of the date of the incident.

Aviation English	A specialised code, based on the English language, used by pilots and air traffic controllers working in international civil aviation, and having standards, phrases, and levels of proficiency established by ICAO.
Aviation language	A specialised code used by pilots and air traffic controllers working in international commercial and civil aviation, having standards, phrases, and levels of proficiency established by ICAO. 'ICAO phraseology' is part of aviation language. While aviation English is the standard code used in international civil aviation, other languages are used in pilot / controller radiotelephony communication and have associated standards and phrases established by ICAO.
British English	The broad variety of English spoken and understood in the United Kingdom. Contrasts with and differs from other varieties of English spoken outside of the United Kingdom (e.g. American English, Australian English) in accent, rate of speech, word choice, norms of interaction and communication, amongst other features.

Bilingualism	The presence of more than one language in radiotelephony communications between air traffic controllers and pilots in countries where English is not a national language, where controllers alternate between aviation English and the local language of the country (ICAO, 2010, pp. 3-7).
Chunking	The brain's preference for grouping items to facilitate recognition of patterns. Chunks may contain familiar intonational directions, such as the upward sweep of pitch that connotes questions. Listeners learn the repetitive patterns of a conversational partner and come to expect information to be grouped in predictable ways (Cushing, 1995; Hunter, 2004, p. 135).
Code-switching	'A common phenomenon of language use referring to the alternation between two or more languages, dialects, or registers in a single conversation (or even a single utterance within a conversation) involving users who have more than one language in common' (ICAO, 2010, pp. 3-6).
Controller	Person responsible for the management of aircraft and airport traffic, including airport ground traffic management, en route air traffic controllers, and approach controllers.
Conversational English	Use of the natural English language outside of regulated situations, e.g. in casual conversation. Similar to plain English.

Language Proficiency Requirements (LPRs)	The set of six language proficiency skills set out in ICAO (2010) with which all pilots and controllers working in international civil aviation must comply. The six skills are Pronunciation, Structure, Vocabulary, Fluency, Comprehension, and Interactions. Pilots and controllers working in international civil aviation must demonstrate proficiency to a minimum Operational Level 4; see ICAO (2010) or their dedicated webpages for more details.
Lingua franca	A language or lingual means of communication between speakers of different and mutually unintelligible languages, which typically has no native speakers (ICAO, 2010, p. 206; Seidlhofer, 2004, p. 211).
Mother tongue	The first language learned to fluency (speaking, reading, writing, listening) by a speaker.
Native speaker (NS)	A user of a language (e.g. English) who was raised learning and using that language as their primary language, generally having used the language to communicate from the time s/he was a child. 'Using' in this context includes not only speaking but also reading and writing the language.
Non-native speaker (NNS)	A user of a language (e.g. English) who did not learn that language as their primary language, generally having learned the language after childhood. Whilst the terms *native speaker* and *non-native speaker* are debated and contentious in some linguistic circles (ICAO, 2010, pp. 2-4), this report is not an academic linguistic paper. Hence the terms native speaker and non-native speaker are used unproblematically throughout the report.
Plain language	'The spontaneous, creative, and non-coded use of a given natural language' (ICAO, 2010).

Plain English	The spontaneous, creative, and non-coded use of English, especially as used in the aviation context to contrast with specialised code of aviation English.

Chapter 1

Management summary

This independent report commissioned by the CAA investigates pilot / air traffic controller communication issues as evidenced by Mandatory Occurrence Reports (MORs), and proposes best practices to reduce miscommunication affected by substandard International Civil Aviation Organisation (ICAO) language proficiency. This report follows an initial literature review of existing research on pilot / controller communication and ICAO language proficiency issues.

The key problems identified by this investigation are:

- Readback-hearback errors (by both UK and non-UK pilots and controllers);
- Call sign confusion (by both UK and non-UK pilots and controllers);
- Language proficiency below ICAO minimum standard (non-UK pilots and controllers);
- Situational awareness reduced due to multilingual radiotelephony (RT), multiple language used and heard on the radio;
- Non-standard phraseology use (by both native and non-native English speakers);
- Grounds to suspect cheating on aviation English exams;
- Grounds to suspect that some non-native English speakers are not being tested, but instead are granted ICAO Level 4 certificates on ‘sweetheart’ deals (handshakes, via friends, etc.);
- ICAO levels of language proficiency, especially Level 4, are not robust enough to ensure appropriately clear pilot / controller communication;
- Poor MOR / language-related reporting culture and underreporting of language proficiency issues by UK pilots and controllers.

The key recommendations of this report are:

1. Increased emphasis in the UK on the importance of reporting language-related miscommunication issues to airlines, the CAA, and CHIRP. Stress that language-related miscommunication issues are as important to aviation safety as any other issue (e.g., mechanical, turbulence, disruptive passengers, etc.);
2. Work with ICAO Member States to agree that English becomes the language of aviation used in all radiotelephony communications when there is a reasonable expectation that it might be of safety benefit to international traffic irrespective of country or local language;
3. Work with European national aviation authorities to reduce language-related miscommunication between UK pilots and controllers based in continental Europe;
4. Increase language testing spot checks and expand SAFAs to include language assessment, to ensure non-UK pilots' levels of English proficiency actually match what their ICAO certificates of proficiency state;
5. Continue working with airlines and EASA to reduce cases of similar call signs operating on similar routes and same radio frequencies;
6. Increase vigilance with pilot and controller readback / hearback. Ensure all participants in radiotelephony communication fully understand the messages that speakers are trying to communicate through measures such as training;
7. Emphasise to pilots and controllers, especially native English speakers, the importance of using ICAO standard phraseology (instead of 'plain language') whenever possible;
8. Relevant national aviation authorities should ensure that no coaching, prompts, or other form of cheating occurs during ICAO Language Proficiency Level certification pilot and controller exams;
9. ICAO language proficiency levels need revising or improving. Current ICAO Level 4 allows for some level of misunderstanding, the evidence is that this

safety risk should be managed more effectively. There should be no room for lack of language proficiency in international aviation.

Chapter 2

Background

2.1 Need for project

Because of the possibility of incidents or accidents due to lack of fluency in English (and the associated risk to the UK public), the Civil Aviation Authority of the UK (CAA) has recognised a need to investigate the state of English language in the aviation system, most notably with respect to air traffic control centres outside of the UK, and pilots operating inside UK airspace.

The work was commissioned by the CAA and funded by the Department for Transport's State Safety Programme to support the desired outcome of reducing the likelihood of miscommunication and increasing clear, effective, and concise communication between native British English-fluent pilots / air traffic controllers, and non-native English-speaking pilots / air traffic controllers.

This document, the second in the present project (and a development of the first deliverable) provides an overview of what language-related miscommunication events between pilots and controllers are being reported to the CAA MOR scheme and reports submitted to the UK Confidential Human Factors Incident Reporting Programme (CHIRP), and provides recommendations for best practices to reduce the likelihood and potential for future language-related miscommunication.

2.2 Context of project

The need for clear and unambiguous communication in aviation has been widely recognized by government regulators, aircraft operators, academics, and those with an interest in safety communications. The potential for miscommunication in interactions of persons who do not speak the same language, have the same socio-cultural knowledge, or share the same tacit expectations and understandings of a communicative event has been widely studied.

In the aviation context, it is imperative that pilots and air traffic controllers are able to communicate efficiently, clearly, unambiguously, and without misunderstanding. However, due to the global nature of aviation, pilots and controllers are unlikely to share the same linguistic fluency and associated understanding of social and cultural norms of communication, interaction, and interpretation.

In the context of pilot/controller communication, there now exists a communicative standard, established and regulated by ICAO, to which all pilots and controllers are expected and required to adhere (referred to in this report alternatively as aviation language or aviation English). Proficiency in aviation language includes both proficiency in ICAO phraseology (sometimes called 'standard phraseology', see ICAO (2007): Chapter 12) and plain language. However, it is becoming increasingly clear through research that not all pilots and controllers are able to adhere to these language proficiency standards, due to various circumstances (e.g. inability to access English language proficiency courses, inability to master the English language).

It is generally recognised that there are pilots operating inside UK airspace who appear to lack the minimum proficiency in English established by ICAO (i.e. Level 4, see ICAO (2010) for more detail about ICAO language proficiency levels); additionally, it is recognized that there are air traffic controllers operating outside of UK airspace who have contact with UK aircraft and who lack the minimum proficiency in English established by ICAO.

2.3 Report creation

This report is created from analysis of data provided by the CAA's MOR database; reports from CHIRP; numerous anonymous informants from the aviation industry and from teachers of English for aviation; and with the invaluable assistance of Graham Greene, Jenny Paul, Pedro Pinheiro, Charlotte Reynolds, Alec Trevett, and Stephen Wheeler from the CAA; Henry Emery, Terence Gerightly, and Elizabeth Mathews from the International Civil Aviation English Association (ICAEA); Philip Shawcross (formerly of ICAEA); Captain Peter Marks (Aviation English Colombia); Peggy Wegler (EF Education First); Ian Dugmore (CHIRP); and Paul Mellor (Anglo-Continental).

Several international aviation industry and safety conferences provided extremely useful information and contacts:

- International Civil Aviation English Association Sixteenth Annual Forum in Istanbul, October 2013
- European Aviation Training Symposiums, Berlin, October 2013 and October 2014
- Seventh Triennial International Fire and Cabin Safety Research Conference, Philadelphia, December 2013
- World Aviation Training Symposium, Orlando, Florida, April 2014
- IATA Cabin Safety Conference, Madrid, May 2014
- Disruptive Passenger Conference, London, June 2014

2.4 Scope of phase two

Early in the project, it was discovered that native English speakers play a significant part in language-related miscommunication, most frequently by not adhering to ICAO standard phraseology and the overuse or overreliance on ‘plain language’. Use of such variety of English can cause confusion and misunderstanding with non-native English speakers because of the wider variety of vocabulary, potential use of slang, and sheer number of words involved in plain language compared with phraseology. Hence the scope of the report also includes this problem.

Because aviation is in a dynamic context and because safety-related miscommunication can take place between more than pilots and controllers, scope for the present analysis was expanded to include pilot-ground and pilot-mechanic miscommunication events. This expansion was not part of the initial scope of the project. However, data which was included in the CAA MOR database searches which did include miscommunication events between pilots and non-air traffic controllers (i.e. between pilots and ground personnel) were analysed to understand the extent of language-related miscommunication in non-in-flight aviation.

2.5 Constraints

A number of factors constrain the content and analysis of this report, which are detailed below.

Lack of detail in language-related MORs

When the proposal for the present project was written, it was assumed that the MOR database would provide ample and suitable data to achieve the goals of the present project. During the course of the project, it became clear that reporting culture in the UK with respect to language and interactional issues (e.g. poor language proficiency, speech rate, non-adherence to ICAO phraseology, accents) could be improved.

In the MOR research database built for the present project, 89 narratives (or 33% of the corpus) reported incidents which were either primarily or in part about language-related events. Almost without exception, these narratives lacked detail about the events. Several narratives mentioned only ‘poor ATC service’ or ‘some communication issues’. See Section 5.1 for further discussion.

Narratives which elaborate on the type of poor service received, including what language-related problems were encountered, or which explain on specific communication issues that were experienced, can help the CAA to better understand what language-related events are occurring, where they are occurring, in what stage of flight, and the outcomes of such events. The CAA will then be in a better position to provide guidance for mitigation or elimination of language-related miscommunication and other events, in the ongoing effort to improve aviation safety and the safety of the UK travelling public.

Recommendation

- Include a greater amount of detail in MOR narratives which centre on or involve language-related issues.

Lack of first-person narratives (i.e. reports written by the witness and submitted to the CAA as it, rather than via an airline or company mediator)

One shortcoming of MORs is that they are often not written and submitted by the person who experienced the event. MORs instead are rewritten and submitted to the CAA by 'middlemen', people who did not experience the events. In the process of rewriting or revising the event report for submission to the MOR reporting scheme, details which for many researchers are crucial to analysis are omitted. Similarly, personal thoughts, comments, opinions, and asides which first-person narratives of aviation incidents can contain help qualitative discourse analysts and other human factors researchers to gain as complete an understanding of the incident and the context in which the incident is situated.

CHIRP reports are a valuable source of information because reporters are anonymous, and written and submitted by the person who experienced the event. CHIRP narratives therefore can contain a great deal of information which is not present to the same extent or at all in MORs, for example, taboo language, personal opinions and attitudes which may not be sanctioned or approved by airline employers, the CAA, or ICAO.

Recommendation

- Increase awareness of the CHIRP reporting scheme amongst UK inflight crew, controllers, and mechanics, including the emphasis on the reporting of language-related incidents.

Lack of original data, e.g. interviews with pilots and controllers, observation

Original data collection specifically for the study was excluded from the present project in an effort to streamline the project and reduce costs. The logic behind this decision was that qualitative data collection and analysis can be time-consuming compared with other types of analyses. Spoken data requires transcription, which is also time-consuming. It was therefore decided to focus on existing textual data from the CAA MOR database, to get an understanding of the state of language-related miscommunication issues as they affect the UK travelling public.

Thus, observations of control towers and flight decks and formal interviews with controllers and pilots are not included as data in the present project. It is hoped that future research on pilot / controller communication and language-related miscommunication will include this type of data.

Chapter 3

Findings from literature review

The first deliverable in the present project was a review of existing research on pilot / controller communication in the international civil aviation context, including English Language Proficiency Requirements established and approved by the ICAO, which became effective for ICAO Member States in 2011.

The literature review identified three significant concerns:

- Most existing research on pilot / controller communication is done from a US point of view, by US-based researchers, or with US interests in mind. This is concerning because the United Kingdom is a different civil aviation context to the US. Its proximity to Europe means that UK-based pilots and air traffic controllers will regularly interact with speakers whose primary languages will likely not be English, which is not the case for the US.
- There is little research available in English with a non-native English-speaking focus. Because UK citizens are global travellers and because the UK is a major destination for non-UK travellers, it is important to understand pilot / controller communication and aviation English proficiency in countries where English is not the primary or national language.
- Most troubling of all is the under-reporting of language-related miscommunication which contributes to incidents and accidents. Without such data, it is impossible to determine the extent to which language and communication contributes to incidents and accidents, and the relationship between English language proficiency and aviation safety.

There were five dominant themes which emerged from the existing research; each theme was divided into subsections. It is worth noting that many areas are interlinked: for example, confusion and misunderstanding was increased when transmissions from non-native English-speaking Thai air traffic controllers included unfamiliar or strong accent, rapid rate of speech, and inclusion of numbers (Tiewtrakul & Fletcher, 2010).

Theme 1 – Universal/historical issues

Issues which have existed and are known to contribute to pilot / controller miscommunication before the implementation of the ICAO Language Proficiency Requirements (LPRs). Lack of aviation language proficiency combined with any or all of these issues likely contribute to miscommunication.

Included in the first theme are:

- Hearer expectation,
- Radiotelephony equipment quality,
- Readback / hearback errors.

Theme 2 – Universal and amplified due to language issues

Issues which have existed prior to the introduction of the ICAO LPRs. However, the increase in international civil aviation and associated increase in interaction and communication between speakers who do not share language backgrounds intensifies and exacerbates the issues below.

Included in the second theme are:

- Accents,
- Code-switching and bilingualism in radiotelephony,
- Complexity and length of controller messages,
- Numbers,
- Speech rate.

Theme 3 – ICAO language issues

Including ICAO LPRs, ICAO standard phraseology, and native / non-native English speaker communication in the aviation context. In the literature review, a surprisingly small amount of research on existing aviation language proficiency lessons, courses, and exams was identified. This is perhaps due in part to the relatively recent implementation of ICAO LPRs (see Alderson 2011, 2009, 2008 for further discussion of ICAO Member States and their respective implementation of language proficiency exams).

Included in the third theme are:

- Aviation English as a lingua franca,
- Disconnect between aviation language courses / exams and real interaction,
- ICAO LPRs,
- ICAO phraseology,
- Oversight, regulation, and assessment of aviation English courses and exams,
- Native English speakers,
- Non-routine radiotelephony messages,
- Plain language versus ICAO phraseology.

Theme 4 – Linguistic issues

Discusses technical linguistic concepts which can contribute to misunderstanding. These issues can combine with other non-linguistic problems, e.g. noisy flight deck environment, poor radiotelephony equipment, fast speech rate, and unfamiliar or incomprehensible speaker accent, resulting in increased confusion, misunderstanding, and miscommunication.

Included in the fourth theme are:

- Ambiguity,
- Homophony,
- Modals,
- Prosody.

Theme 5 – Socio-cultural issues

Devoted to issues which stem from primarily social and cultural factors. While communication does not happen in a vacuum, most pilot / controller communication occurs within a highly regulated and controlled context, in regular patterns, and at predictable phases of flight. However, pilots and controllers working in international civil aviation are individuals and come from many different societies and cultures. As such, they have different norms of communication, interaction, and interpretation

which are difficult to eliminate in radiotelephony communication, despite the great deal of training and regulation present in civil aviation.

Included in the fifth theme are:

- Language and cultural awareness,
- Politeness.

These issues are discussed with respect to the MOR data in Section 6.

Chapter 4

Data sources and methodology

The database of MORs was used as the primary source of data, as it was available to the researcher, easily accessible, and it was thought that it would provide the most accurate representation of language-related miscommunication and impacts on safety in UK-based aviation.

The database was searched for reports dated between 1 January 2012 and 30 June 2013, as these date parameters provided the researcher with the most recent reports in an 18-month period, including a full calendar year from 1 January to 31 December.

An initial database search was conducted in October 2013 with the following search terms:

1. Accent
2. British
3. Communicate
4. Communication
5. English
6. Enunciate
7. Enunciation
8. Foreign
9. Foreigner
10. Heard
11. Language
12. Meaning
13. Miscommunicate
14. Miscommunication
15. Mishear
16. Misheard
17. Mispronounce
18. Misspeak
19. Misspoke
20. Misunderstand
21. Misunderstood
22. Pronounce
23. Unclear
24. Understand
25. Understood

These terms were chosen by the researcher to ‘test the waters’, so to speak: to see what results would be returned and which terms would be more applicable to the present project. The search yielded 546 events. Several terms yielded either no results or returned MORs which were not applicable to the present project. Others

were redundant; e.g. Communicate, Communication, Miscommunicate, and Miscommunication all have the same ‘communicat-’ root, therefore the search term ‘communicat-’ could have been used to return the same results.

A second search of the MOR database was conducted after search 1, using a more refined and focused search methodology. The search was executed based on explanatory factors (e.g. interface between humans). This second method yielded 184 events, 142 of which contained language-related miscommunication as a contributory factor to the incident.

Not all of these 142 events were unique to the second search result, and several were also in database search 1. There were, however, events in the first search which were not included in the second. One explanation for this non-overlap is that language-related miscommunication can encompass a wide variety of issues, factors and influences. Moreover, MOR narratives can refer to language-related miscommunication in a number of ways (e.g. as a primary cause and therefore the main focus of the narrative or as an aside or afterthought and referred to in the final sentence of the narrative). Thus careful reading of each MOR narrative was required to understand if language played a part in the incident being reported.

After an analysis of the results for both MOR database searches, 267 reports were found to be related to miscommunication in some way, either the primary focus of the reported incident or concern of the reporter (less common), or ancillary to another event (as was the case with the majority of MORs which contained language-related miscommunication).

Some reports were included for analysis which did not strictly adhere to the project brief (international commercial pilot / controller communication) but which demonstrated language-related miscommunication and potential for safety risks (e.g. pilot / tug operator communication, prolonged loss of communication, general aviation, private / business aviation, student pilots). These reports were included in the analysis due to the overarching remit of the present project which is to investigate how language-related miscommunication affects the safety of the UK public.

The researcher was able to access the UK CHIRP report database for potential data for the present project. The database search yielded 15 commercial pilot reports, 13 ATC reports, and 10 General Aviation reports submitted in the date parameters of 01/01/2012 – 30/06/2013 and containing miscommunication events. Of these reports, three (3) commercial pilot reports and one (1) ATC report are applicable for the present project. Because of the small amount of reports, they have not been included in the overall analysis for the present project. However, applicable CHIRP reports will be discussed throughout the report when appropriate.

It is worth briefly discussing the merits of the CHIRP reports that were accessed. Most CHIRP reports that were accessed in the course of researching the present project (including those within and outside the chosen date parameters) revealed a tension between UK pilots and UK controllers. Similar to an 'us and them' ideology, many pilot reports seemed to regard air traffic controllers as working in opposition to the goals of pilots, and vice versa. For example, a controller referred to pilots as 'getting lazier in their readbacks'; a pilot suggests that some controllers have attitudes of 'why can't you chaps on the other side of the radio just do as you are told?'. This tension may be worth further investigation.

An initial content analysis was conducted, and the reports were read and put into ad-hoc categories. The following table includes the categories and the number of MORs from each year (01/01/2012 – 31/12/2012 and 01/01/2013 – 30/06/2013).

Table 1: MOR categories and years

Category		2012	2013	Total	% of corpus
1.	UK ATC misunderstanding non-UK pilot	2	1	3	1
2.	UK ATC misunderstanding pilot (unclear origin)	4	2	6	2
3.	Non-UK pilot misunderstanding UK ATC	10	2	12	5
4.	Pilot (unclear origin) misunderstanding UK ATC	27	21	48	18
5.	UK pilot misunderstanding non-UK ATC	48	31	79	30
6.	Non-UK ATC misunderstanding UK pilot	13	6	19	7

Category		2012	2013	Total	% of corpus
7.	Pilot (unclear origin) / ATC (unclear origin) miscommunication	0	3	3	1
8.	Mutual ATC / pilot misunderstanding	8	7	15	6
9.	Non-UK ground staff (non-ATC) communication difficulties	12	3	15	6
10.	UK ground staff (non-ATC) issue	10	4	14	5
11.	Unclear if UK ground staff (non-ATC) issue	2	1	3	1
12.	Other miscommunication	22	1	23	9
13.	ATC did not catch error	37	24	61	23
14.	Pilots missing ATC call / Prolonged Loss of Communication (PLOC)	14	8	22	8
15.	Unclear if language-related	111	61	172	65
16.	Generic ‘poor communication’ and similar (lacking important details)	51	23	74	28
17.	Laser	3	1	4	2
18.	Numbers	22	22	44	16
19.	Call sign / flight number confusion	28	12	40	15
20.	Waypoint confusion	4	1	5	2
21.	Left / right confusion	1	1	2	1
22.	Non-standard phraseology	11	5	16	6
23.	Multilingual RT – multiple languages on radio	12	6	18	7
24.	Speech rate – rate of speech (ATC or pilot)	2	0	1	1
25.	Accent	7	3	10	4
26.	Poor headset quality – excessively noisy flight deck	9	1	10	4
27.	Hearer expectation	2	1	3	1

NB: percentages are rounded up

The initial project proposal called for a qualitative microanalysis of MOR narratives to gain further insight into language-related pilot / controller miscommunication. However, because of the confidential nature of the MORs, coupled with the lack of detail in narratives regarding language-related miscommunication, such a fine-grained analysis was limited.

A second analysis of the data was conducted, looking in greater detail at certain themes relevant to the project, and at themes which emerged from the data. These are discussed in Sections 6 and 8.

Chapter 5

Mandatory Occurrence Reports: overall themes

Several themes emerged from the analysis of the MOR corpus of 267 reports compiled for the present project. Some of these themes concur with themes that emerged from the literature review, the first part of the present project. These themes are discussed further in Section 6.

The following sections focus on themes which emerged as salient to pilot / controller communication and aviation safety. Section 5.1 discusses the disparity between the perceived problem of substandard ICAO language proficiency for non-UK pilots and controllers and existing data in the MOR database. Section 5.2 discusses UK pilots misunderstanding non-UK controllers, while Section 5.3 discusses non-UK pilots misunderstanding UK controllers. Section 5.4 discuses miscommunication between pilots and non-ATC ground staff, a theme which, while not explicitly concerned with communication between pilots and controllers, nonetheless affect aviation safety. The last section, 5.5, discusses mitigation of language-related incidents.

5.1 Disparity between perceived problem and MOR-based evidence

Data

The MOR corpus compiled for the present project contained 267 reports in which there was some kind of miscommunication (e.g. call sign confusion, Prolonged Loss of Communication (PLOC)). Of this set of reports:

- 33% (87 reports) explicitly refer to language-related miscommunication;
- 28% (74 reports) contained a very brief reference to miscommunication of some kind but without any detail;
- 65% (172 reports) were unclear if the miscommunication was related to language proficiency, or stemmed from some other cause or combination of causes. Eighty-nine (89) occurred in the UK, 60 outside of the UK, and 21 were unclear where the event occurred.

Analysis

During the course of the project, the researcher spoke with several aviation safety and language teaching professionals about the extent of language proficiency-related miscommunication in aviation. All agreed that poor language proficiency and language-related miscommunication more broadly are widespread problems having major safety implications. However, there is a disparity between perceived problems and threats to safety, and MORs submitted to the CAA which explicitly refer to language as a factor in the incident being reported. Given the number of flights (commercial, general, and other) which UK pilots and controllers experience in a year, a larger number of language-related miscommunication events were expected to be in the MOR database than the 87 reports found in the corpus.

There are at least two explanations for this. Either the problem of language proficiency and language-related miscommunication is not as widespread as assumed or language-related miscommunication events are not being sufficiently documented.

When language or miscommunication is referred to in an MOR narrative, it is often mentioned at the end of the narrative, and frequently with little if any information, detail, or elaboration about the type and extent of language issue. This lack of detail meant that the researcher could not gain the desired insight into the extent to which language proficiency, and language-related miscommunication more broadly, are affecting the safety of the UK travelling public. Table 2 offers a brief selection of examples of this type of lack of detail.

Table 2: Example of lack of detail miscommunication

MOR excerpt	MOR file number
“issues with ATC”	********596
“very poor ATC service”	********435
“possible language difficulties”	********816
“high volume of unclear comms from ATC”	********043
“communications difficulties with ATC on ground with poor English”	********242
“ATC grasp of English seemed very poor”	********322

Conclusion

A more detailed description of the language-related issues (e.g. what was said, how it was said, rate of speech, accent, etc.) would help the CAA to gain a more in-depth understanding of language-related miscommunication, including existing substandard ICAO language proficiency encountered by UK pilots and controllers.

Recommendations

- Emphasise the importance of reporting language-related miscommunications and misunderstandings. Clarify that 'language-related' can include accents, dialects, poor English skills, and any other issue that is related to communication and interaction.
- Improve reporting culture and practice with respect to language-related incidents. Especially emphasise the importance of reporting explicitly and specifically what miscommunication or misunderstanding happened as a result of poor language proficiency. Note that 'some language issues' is inaccurate, too vague, and not detailed enough to allow analysts to better understand the number and details of incidents related to poor English language proficiency.
- Have a discrete section or tick box on MOR forms for language-related miscommunication, e.g. 'Do you believe that language proficiency contributed to, exacerbated, or caused this incident?'

5.2 UK pilots / non-UK ATC miscommunication

Data

37% of the MOR report corpus (98 reports) contains some event whereby there was miscommunication or misunderstanding between a UK-based pilot and a non-UK controller. This group comprises the majority of miscommunication events in the corpus. Of this set of reports:

- 30% (79 reports) are events whereby UK pilots misunderstood non-UK controllers;
- 7% (19 reports) are events whereby non-UK controllers misunderstood UK pilots;

- 15% (40 reports) cite non-UK controllers' below-ICAO English proficiency as a cause for miscommunication and misunderstanding.

Analysis

MORs show that language-related miscommunication between UK pilots and non-UK controllers is happening at all phases of flight, from starting to taxi, climb to cruise to descent and landing. The majority of language-related miscommunication between UK pilots and non-UK controllers as evidenced in the MOR database is, unsurprisingly given its proximity to the UK, happening in mainland Europe.

Misunderstanding and miscommunication occurred either through the controllers' substandard English language proficiency, use of non-standard phraseology, non-English (i.e. local language) accent, use of local language in radiotelephony (RT), poor quality of radio frequency, excessive RT transmissions during critical phases of flight, call sign confusion (including not using full call sign), ATC simply not contacting pilots, and ATC not responding to pilot contact.

It is possible that UK pilots played a part in the miscommunication, for example via rapid rate of speech, use of non-standard phraseology, and excessive use of plain language in non-routine and emergency situations. Use of plain language can confuse non-native English-speaking pilots and controllers if they are not fluent in the natural language, or not familiar with plain language (Moder, 2013). Native English speakers can also have an ideology that because they are native speakers of English, their way of speaking is the only 'correct' one, and non-native English speakers must be the ones at fault in miscommunication events. Native English speakers sometimes show impatience with non-native English speakers, often reflected in increasing speech rate and volume (Bieswanger, 2013; Howard, 2008, p. 371; Said, 2011).

Another complicating factor is that native English speakers often do not have to undergo tests of their knowledge of ICAO phraseology and language proficiency because they are frequently automatically granted or assessed at ICAO Level 6 (Alderson, 2009, p. 181; CAA, 2007).

Conclusion

It is clear that not all controllers working outside of the UK demonstrate the minimum ICAO language proficiency required to work in international aviation.

Ultimately, responsibilities for communication problems in aviation language are distributed across both native and non-native English speakers. Thus both native and non-native English speakers must accept responsibility for their utterances, and ensure that they are speaking as clearly and concisely as possible.

Recommendations

Non-UK controllers

- Conduct research specifically into the language proficiency of non-UK controllers. This research should focus on countries in which an accident or serious incident would pose the greatest risk to the UK travelling public, e.g. countries most frequently visited by the UK travelling public.
- Work with other national aviation authorities to further investigate language-related miscommunication between UK pilots and controllers based in mainland Europe.

Pilots and controllers

- A core part of the training of all pilots and controllers should involve communication strategies to facilitate successful and efficient communication with speakers from diverse language backgrounds.
- Such strategies could include simplification of speech and avoidance of redundant information, paraphrasing of utterances when these are found to cause problems of comprehension, and more judicious deployment of available language resources, including the existing aviation phraseology repertoire (Kim & Elder, 2009, p. 23.15; Koble & Roh, 2013, p. 48; Moder, 2013, p. 240).
- Native English-speaking pilots and controllers should train in the use of ICAO phraseology in situations of stress. Training scenarios should replicate as much as possible real-life scenarios (Moder, 2013).
- Train to pause between ‘chunks’ of information (Cushing, 1995; Howard, 2008, p. 386).

- Train to not speed up rate of speech in periods of high stress (Said, 2011, p. 24).

Native English-speaking pilots

- Native English speakers should think of English in the flight deck or over the radio as not English as they know it, but instead as a different 'language'.
- On-going language awareness training should be implemented.
- Language awareness training should emphasise the elimination of local slang and non-standard phraseology.
- Language awareness training should incorporate awareness of non-native English listeners in training.

5.3 UK ATC / non-UK pilots miscommunication

Data

26% of the MOR corpus (69 reports) contain some event whereby there is miscommunication or misunderstanding between UK controllers and pilots. Of this set of reports:

- 6% (15 reports) represent events whereby there was language-related miscommunication between UK controllers and non-UK pilots;
- 20% (54 reports) were of events containing language-related miscommunication between UK controllers and pilots of unclear origin (i.e. it was not possible from the MOR narrative to determine if the pilots involved were UK-based or from outside of the UK).

Analysis

Of the reports citing miscommunication between UK controllers and non-UK pilots, all but one cited the substandard language proficiency of the pilot as causing or exacerbating the event. Eleven (11) events occurred in air, either during climb, cruise, or during a circuit pattern. Incidents include failing to fly the instructed heading, failing to follow the correct SID, and infringement of airspace. Most significant is that these incidents occurred over the UK, meaning that many UK citizens might have been affected had an accident occurred.

The MORs did not specify country of origin of the pilots involved in the language-related events. Thus it is impossible for the researcher to know what country the pilots involved in these events are from (or in which country they are licensed).

Of the reports citing miscommunication between UK controllers and pilots of unclear origin, these events included call sign confusion; ATC mishearing reported flight levels; misunderstanding ATC instructions; runway incursions; loss of separation; deviation from assigned flight level; and airspace infringement.

Conclusion

Without more detail in MOR narratives, it is impossible to know if all pilots in this 'unclear origin' category are from outside the UK and potentially not native speakers of English. However, it would be difficult to accurately identify specific countries of origin of pilots involved in language-related miscommunication events. What is more achievable is to use the country of registration for aircraft involved in language-related events, which would add more information to MORs without compromising confidentiality of involved companies, airlines, or individuals.

Recommendation

- Collaborate with national aviation authorities to understand further the challenges of ICAO language proficiency, and work to formulate common approaches to address these challenges and improve aviation safety.

5.4 Pilot and ground staff miscommunication (non-ATC)

Data

11% of the corpus (29 reports) cited miscommunication between pilots and ground staff (i.e. not controllers). Of this set of reports:

- 6% (15 reports) contain communication issues between UK pilots and non-UK ground staff;
- 5% (14 reports) contained events with miscommunication issues between UK ground staff and pilots.

Analysis

Scope of the project was expanded to include language-related miscommunication between UK pilots and ground staff. This expansion of scope was because aviation safety includes more than only pilot / controller communication. Controllers for the most part interact solely with pilots; pilots interact with several different actors in aviation, all of whom play a part in the safety of the aircraft. Tug drivers, mechanics, catering, and baggage loading staff all interact with UK pilots and must be able to communicate clearly with no ambiguity or misunderstanding.

Of the reports citing communication issues between UK pilots and non-UK ground staff, these events occurred with tug drivers, maintenance staff, pushback crews, ground crew, engineers, and baggage loading staff.

Three reports did not give specific ground staff with whom UK pilots had communication issues but instead referred to ‘language difficulties’ in resolving an incident with chocks blocking the taxiway; ‘language barrier’ making it difficult to quickly resolve incorrect figures; and the operation of a commercial flight without a valid Certified Release to Service following minor maintenance following a breakdown in communication between the operator and Continued Airworthiness Organisation.

Of the reports citing miscommunication between UK ground staff and pilots, MORs are not specific if pilots are UK-based or are from outside of the UK. This lack of specificity means that this report cannot provide detail regarding language-related miscommunication between UK ground staff and non-UK pilots.

However, some of the MORs are clear in language-related miscommunication with respect to UK ground staff. The MORs show that UK ground staff are using non-standard phraseology resulting in miscommunications with pilots and with ATC. Ground staff include tug drivers, de-icing crews (File Number ******355, Location UK – reports inadequate de-icing due to de-icing crew’s poor English proficiency), ground crews, and catering staff.

This miscommunication is happening in LHR (three events), LGW (five events), BHX (two events), LCY, Manchester, Aberdeen, and Glasgow (one event each).

Conclusion

These incidents are not without consequence or threat to aviation safety. Inability to clearly communicate with mechanics or pushback crews can have major safety implications: an event (the location of which was not given in the MOR) reports that foreign maintenance staff did not read thoroughly and understand procedures. It is vital that communication between pilots and ground service personnel is clear and unambiguous.

Recommendations

- Implement a standard level of English language proficiency for all ground staff, including tug drivers, ground crew, pushback crew, catering, and baggage loading staff.
- English language proficiency spot checks could be conducted along with or in the same manner as Safety Inspections of Foreign Aircraft (SAFAs).

5.5 Mitigation of language-related incidents

Data

18% of the corpus (48 reports) include use of the term ‘alleged’, ‘alleges’, or ‘allegedly’ when reporting an event. Of this set of reports:

- 8% (21 reports) cite language-related miscommunication events.

Analysis

The use of these terms is interesting because ‘alleged’ suggests that there is some doubt if the incident or event being reported did in fact happen. But the MOR would not have been written and submitted without an incident happening.

Some reports directly contradict themselves, using ‘alleged’ in the headline and repeating the same line with ‘alleged’ removed in the narrative.

For example, File Number ******019, location Middle East, in the headline states ‘Alleged poor ATC service.’ The narrative states ‘Reporter commented on ATC’s poor command of English and low level of situational awareness.’ The narrative gives no mitigating actions that took place, instead providing a clear (albeit not very

detailed) picture of a controller who likely does not possess the minimum required level of proficiency in English to work in international aviation, and who may be a threat to aviation safety.

It should be mentioned that individual MORs are reviewed and appropriate safety action taken at the time. The value of this report is considering a wide range of language-related safety incidents and subjecting them to specialist review.

Another example, File Number *****716, location Middle East – the headline reports 'various communication issues allegedly experienced with ATC during pushback.' The narrative states, 'Reporter commented that the communication issues led to flight crew's workload increasing during several busy stages of flight, at night, which had flight safety implications.' Like the previous MOR, the narrative contradicts the headline, with the reporter in the narrative asserting that communication issues occurred which interfered with flight safety.

Finally, File number ******471, location Southern Europe – the headline refers to 'alleged inaccurate ATIS information'; the narrative references the 'inaccurate ATIS information' – same phrase minus 'alleged'.

Conclusion

Such a mitigating term as 'alleged' is used when committing what linguists call a face-threatening act; that is, a linguistic 'threat' or insult to another person's status, authority, power, or hierarchical position. Speakers may not want to be perceived as instigating an actual insult or blow to another's position of power (particularly when the other holds a position higher in status, power, authority, or hierarchy than the speaker). Equally it could be the case that a speaker does not want to accept responsibility for what they may be accusing someone else of. Hence the strategic use of mitigation terms such as 'alleged'.

Another interpretation is that may be the case that there is information which those who submitted the MORs are not saying, owing to use of allegedly. The word is a sort of get-out clause: this incident may have happened but maybe not. It may be the case that information is being withheld from the MORs, hedged by the term 'alleged'. Should this information come out in future, the reporter has covered her - or himself,

presenting an event which may or may not have happened, and there may or may not be more information about the event.

Chapter 6

Findings from literature review applied to data analysis

6.1 Universal / historic issues

These are issues which have existed and are known to contribute to pilot / controller miscommunication before the implementation of the ICAO LPRs. Lack of aviation language proficiency combined with any or all of these issues likely contributes to miscommunication.

Hearer expectation

Hearer expectation can be realised in several ways, explicitly via specifically citing that the reporter erred due to hearer expectation; via call sign confusion; via readback or hearback error; via waypoint confusion, or in some other way.

Data

- 23% (61 reports) cite ATC error whereby ATC either had call sign confusion or readback-hearback error. Of this subset of reports:
- 10% (26 reports) occurred in the UK;
- 10% (26 reports) occurred outside of UK airspace;
- 3% (9 reports) were unclear where the event occurred.
- 5% (13 reports) cite pilot error whereby pilots either had call sign confusion or readback-hearback error. Of this subset of reports:
- 3% (9 reports) occurred within the UK;
- 1% (2 reports) occurred outside of UK airspace;
- 1% (2 reports) were unclear where the event occurred.
- 15% (40 reports) cite call sign confusion.
- 2% (5 reports) cite waypoint confusion.
- 1% (3 reports) explicitly cite hearer expectation as a factor in the event.

Readback-hearback errors are discussed in Section 6.1, ‘Readback-hearback errors’, below. This section discusses call sign confusion and waypoint confusion.

Analysis

Many MOR narratives in the corpus are concerned with the confusion of call signs which lead to level busts, TCAS RAs, and other non-routine events which have the potential to develop into something more serious. Fatigue (pilot and controller) can affect the ability to deal with stress or handle increased workloads.

This situation alone can contribute to miscommunication on the part of controllers confusing call signs or even pilots themselves confusing call signs. However, the potential for misunderstanding and miscommunication is increased when substandard ICAO language proficiency is present.

It was not possible to determine from the MOR data how many UK pilots and UK controllers had hearer expectation errors. The data show that the majority of call sign confusion and readback-hearback error events occurred within UK airspace, posing a risk to the UK public.

In 2006, Eurocontrol identified call sign similarity as a significant contributor to air-ground communication issues. Subsequently, the Eurocontrol Call Sign Similarity (CSS) Service was initiated with the aim of establishing pan-European call sign similarity solutions centred on a coordinated service operated by Eurocontrol's Network Manager Operations Centre, with the aim to reduce the level of operational call sign confusion events and therefore improve levels of safety.

Of the five events of waypoint confusion, two occurred in UK airspace. These two events involved similar-sounding waypoints (BASET / BADSI; OKTEM / OCKHAM). Both events involved UK controllers and non-UK pilots whose language proficiency was remarked upon in the narratives.

Of the three events occurring outside of UK airspace, two involved waypoint confusion (BEPER / OBEPA in French airspace; BANKY / BENTI in Danish airspace) and one involved a clearance confusion (SHIRI / KEREN in Israeli airspace).

Conclusion

Call sign similarity and confusion by both UK pilots and UK controllers continues to be a threat to aviation safety in both UK airspace and outside the UK. Waypoint confusion poses a smaller risk than call sign confusion to aviation safety.

Recommendations

- Continue working with the Eurocontrol Call Sign Similarity Service to reduce the number of similar call signs on the same frequency or operating on the same or similar routes.
- Monitor MORs for further waypoint confusion events and take action if necessary.

Radiotelephony equipment quality

Data

4% of the corpus (10 reports) contain reference to radiotelephony equipment issues. Of this set of reports:

- 2 reports of headset issues, including uncomfortable and ill-fitting headsets;
- 1 report of difficulty in synchronizing VHF and interphone volumes;
- 1 report of garbled ATC message;
- 1 report of poor radio equipment quality;
- 1 report of noisy frequency;
- 1 report of noise on flight deck;
- 1 report of poor radio reception;
- 1 report of poor quality of controller transmission;
- 1 report of poor quality VHF communications.

Analysis

Lack of quality standards affects communication. Poor quality or malfunctioning radiotelephony equipment, including headsets and microphones, causes interference, static, and other negative influences on pilot / controller communication (Cushing, 1994; Howard, 2008, p. 372; Prinzo, et al., 2010a; van Es, 2004, p. 30).

Additionally, current radiotelephony equipment used by pilots and controllers have the following constraints to open communication:

- Only one person may speak at a time;
- Transmission quality varies by radio;
- Both parties must monitor and transmit on a common frequency;
- Static and ambient noise are constant impediments to clear signal transmission and reception (Howard, 2008, p. 372).

Conclusion

MOR data show that poor quality radiotelephony equipment contributes to and at times causes miscommunication between pilots and controllers. Issues with radio frequency affect pilot / controller communications in locations outside of the UK.

Recommendations

- Set a minimum standard of quality for radiotelephony equipment, including headsets and microphones, for commercial aircraft operated by UK airlines.
- Monitor radiotelephony communications inside of the UK for quality.

Readback-hearback errors

Readback and hearback are essential parts of pilot / controller communication and, perhaps due to their ubiquity, offer great potential for errors which, if uncorrected, can contribute to miscommunication and be a threat to safety (Cushing, 1995).

Data

21% (55 reports) contain events whereby either controllers or pilots had readback or hearback errors. Of this set of reports:

- 16% (42) were controller errors. Of this subset of reports:
  - 8% (21) were controller errors that occurred in UK airspace;
  - 6% (15) were controller errors that occurred outside of UK airspace;
  - 2% (7) reports were unclear where events occurred.
- 5% (13) were pilot errors. Of this subset of reports:
  - 3% (9) were pilot errors that occurred in UK airspace;

- 1% (3) were pilot errors that occurred outside of UK airspace;
- 1 report was unclear where event occurred.

Analysis

The MOR analysis shows that the majority of readback-hearback errors reported to the CAA are controller errors. These errors involved incorrect call signs (call sign confusion), incorrect flight levels (usually off by one number, e.g. FL360 / FL260), or incorrect runways (e.g. File Number ******498, Location LHR – A320 cleared to R/W27R, readback incorrect R/W27L which controller did not catch). Level busts (altitude deviations) were the most common result of readback-hearback errors.

Many of these errors happened due to stepped-on transmissions, controller distraction, or hearer expectation (or a combination of these factors).

Of the controller errors which occurred outside of the UK, four involved language-related miscommunication (controller accent affecting understanding; multilingual radiotelephony in French and English; and one report citing poor communications with ATC).

Of the controller errors which occurred inside UK airspace, only one involved language-related miscommunication:

- File Number ******808, Location Scotland – controller misheard B757 say (in heavily accented English) their stand; controller heard 32, actual stand number was 26.

It is not possible from the MORs to determine if UK controller errors were with UK pilots or with pilots from outside of the UK.

The MOR analysis shows that controller errors are reported three times more frequently than pilot errors. When pilot errors are reported, they are three times more likely to occur in UK airspace than outside of the UK.

Of the pilot errors which occurred outside of UK airspace, no MOR cites language-related miscommunication as a factor. Of the pilot errors which occurred inside UK airspace, only one involved language-related miscommunication:

- File Number ******816, Location UK Midlands – Runway incursion. instructed to taxi to holding point for R/W22 via R/W34 was observed taxiing at speed toward R/W22 hold, subsequently turning onto R/W22 before confirming they were ready for departure. [Identifier removed] failed to readback R/W22 before confirming it was acceptable. Reporter made reference to possible language difficulties.

As discussed in Section 5.1, this reference to language difficulties does not provide sufficient detail to understand the type of language difficulties (e.g. accent, substandard proficiency) that the pilot had. Also note the mitigation, with the word 'possible', discussed in Section 5.5.

Conclusions

Overall, numbers are a common factor across readback-hearback errors, including mishearing flight levels and mishearing call signs. Accent and substandard language proficiency also contribute to miscommunication. While these events were resolved without accident, they are not trivial: any could have had much different consequences. Language-related miscommunication exacerbates already existent errors.

Recommendations

- Increase awareness amongst UK pilots and controllers of language-related miscommunication in readback-hearback errors;
- Monitor MORs for language-related miscommunication in readback-hearback errors both inside UK airspace and outside of the UK;
- Have a discrete tick box on MOR forms for language-related miscommunication as a factor in reported events;
- Investigate the extent to which readback errors by non-UK pilots operating in UK airspace contributes to miscommunication and aviation incidents. Appropriate steps should be taken to address and correct readback errors by non-UK pilots operating in UK airspace.

6.2 Universal and amplified due to language issues

Like the issues in Section 6.1, these issues existed prior to the introduction of the ICAO LPRs. However, the increase in international civil aviation and associated increase in interaction and communication between speakers who do not share language backgrounds intensifies and exacerbates the following issues.

Accents

Data

4% (10 reports) concerned events whereby a speaker's accent played a part in the event. Of this set of reports:

- 3% (7 reports) involved controller accent, occurring outside of the UK;
- 1% (3 reports) involved pilot accent, occurring in UK airspace.

Analysis

As we grow accustomed to hearing one variety of language in our daily lives, unfamiliar varieties can sound jarring or 'foreign', and it can take some time to acclimatise ourselves to the different sounds (Hunter, 2004, p. 138; Monteiro, 2012, p. 62; Prinzo, et al., 2010a; Tiewtrakul & Fletcher, 2010).

The events involving controller accent occurred in Bangkok, Paris-CDG, Paris-Orly, Toulouse Blagnac, Delhi, Cairo, and Barcelona. The data show that controller accent affects communication in all phases of flight, and often coincides with readback-hearback errors.

Events involving pilot accent occurred in Compton, Glasgow, and VEXEN airway. Miscommunication events resulted in separation being lost (Compton), conflicting pushback clearance (Glasgow), and infringement of Airway Q41.

No event involving pilot accent was reported taking place in any London airport, which is surprising, given the number of flights which originate and have destinations outside of the UK.

Conclusion

Accent affects clear and concise communication between pilots and controllers, resulting in excessive time on radio frequency, loss of situational awareness, and added stress. Because UK pilots and controllers are going to encounter and interact with speakers from outside of the UK whose native language is not English, it is imperative that they are well-trained and prepared to attune their ears to the range of accents that they will encounter during their flying career.

Recommendations

- Increase vigilance in reporting incidents involving non-native English accents and miscommunication at UK airports;
- Include in aviation English classes training to understand different accents heard in English, including so-called 'native' varieties (e.g. Indian English, South African English) as well as non-native speaker varieties (Koble & Roh, 2013, p. 51);
- Address variations in intonation, rhythm, and pauses that native and non-native English speakers have (Estival & Molesworth, 2009, p. 24.5; Koble & Roh, 2013, p. 51; Moder, 2013, p. 235);
- In teaching syllabi tailored to the needs of non-native English speaking aviation personnel, focus attention on core features of pronunciation, including initial consonants, that need to be mastered for mutual intelligibility between English users from different native language backgrounds (Koble & Roh, 2013, p. 51; Said, 2011, p. 21);
- Include in pilot and controller training familiarisation with non-native English-speaking accents. Replicate real-life conditions in training conditions, e.g. include noisy flight deck environment, poor sound quality, busy tower environment;
- Incorporate in flight planning and preparation familiarisation techniques with accents that pilots are most likely to encounter during their flight.

Code-switching and bilingualism in radiotelephony – reduction of pilot situational awareness due to multiple languages on the radio

Code-switching (alternating between two or more languages, dialects, or registers in a conversation, or utterance in a conversation, involving users having more than one

language in common) and bilingual radiotelephony communications (more than a single language being used for radiotelephony communications) are routinely cited by safety bodies, academics, and practitioners as contributing to miscommunication and loss of pilot situational awareness. This serious problem is reflected in the much of the literature consulted for the present study (Cookson, 2009; ICAO, 2010; Moder, 2013; Prinzo, et al., 2010b; Prinzo, et al., 2010c; Prinzo & Campbell, 2008).

Data

7% (18 reports) contained events whereby multiple languages in radiotelephony were cited as contributing to miscommunication or reducing situational awareness. Of this set of reports:

- 5% (12 reports) involved French;
- 2% (6 reports) involved Spanish;
- All events occurred outside UK airspace.

Analysis

The analysis shows that Spain and France, major aviation destinations for the UK travelling public, are the most frequently cited countries where multilingual radiotelephony reduces situational awareness. This is not surprising, given the proximity of France and Spain to the UK.

Equally, given that it is widely known that Spain and France are countries where language-related miscommunication is likely to occur, and where local languages are likely to be heard alongside English in radiotelephony communication, it could be the case that there is reporter bias: we are more sensitive to a situation, therefore we are more likely to notice it, and hence report it.

Conclusion

Reduction of pilots' situational awareness is a large threat to aviation safety. All possible and achievable actions should be taken to limit such threats.

While the practice of speaking local languages alongside English in international radiotelephony is in keeping with ICAO procedures, given this data and the countless anecdotal and other evidence experienced by many UK-based pilots, we must

question whether the risk to safety is worth the convenience of the use of local languages along with English in international radiotelephony.

However, it must be recognised that a monolingual radiotelephony approach to the use of English that would also include non-commercial aviation (such as small club aircraft) may be unachievable, and have a detrimental impact on overall safety. Hence an approach that takes into account all factors needs to be devised.

Recommendation

- Work with ICAO Member States to assess whether the adoption of English as the sole language in commercial aviation, both in radiotelephony transmissions and at the ground level in airports, represents the best approach to optimal situational awareness, radiotelephony communication, and aviation safety.

Complexity and length of controller messages

Auditory short-term memory performance declines rapidly at about 15 seconds from the onset of new information (Hunter, 2004, p. 138). Lengthy messages containing several instructions contribute to pilots' cognitive workload (Moder, 2013, p. 235). Controllers' messages longer than 15 seconds, therefore, are likely to be difficult for pilots to remember, especially non-native English-speaking pilots interacting with English-speaking controllers (Said, 2011, p. 23).

Segments of communication with prescribed boundaries may be described as perceptual 'chunks'. Chunking refers to the brain's preference for grouping items to facilitate recognition of patterns. Chunks may contain familiar intonational directions, such as the upward sweep of pitch that connotes questions. Listeners learn the repetitive patterns of a conversational partner and come to expect information to be grouped in predictable ways (Cushing, 1995; Hunter, 2004, p. 135).

Non-native speakers of English may not use the familiar intonational directions that help to signify chunks which native speakers of English expect to hear to the extent that native speakers of English use. This difference can contribute to misunderstanding and miscommunication between native and non-native English speakers.

Howard (2008, pp. 384, 386) found that as the quantity of information in a radio transmission increases, the chance of problematic communication in the subsequent message will also increase. Transmissions or messages that included more information created problems for both pilots and controllers. The addition of expressions that deviate from the expected format likely aggravate this issue. Similarly, Tiewtrakul and Fletcher (2010) found that communication errors in controller / pilot interaction in Thailand increased when speakers were both non-native English and when complexity of message increased.

Data

No MOR in the corpus explicitly addressed controller message length.

Two CHIRP reports explicitly discussed controller message length, discussed below.

Analysis

Given the amount of literature on controller message length, it was surprising that no MOR reported this issue. It could be the case that this issue is not a concern for UK pilots. Equally it could be the case that controller messages are sometimes too lengthy but the incident is forgotten as soon as it is resolved and thus never reported.

The two CHIRP reports provide differing opinions, both submitted by UK pilots.

One pilot states that it is good practice for UK controllers to not give flight level and radio frequency instructions in the same transmission, but instead to split them into separate transmissions with a minimum of 10 seconds between transmissions in order to lessen flight deck disruption.

The second report, also from a commercial pilot, argues that it is needless to split controller instructions that contain both flight level clearance and radio frequency instruction, stating that it makes more work for pilots to attend to multiple transmissions.

Both arguments have merits: while too much information in controller transmissions is a threat to safety, too many radio transmissions can cause pilot distraction. When we take into consideration the difficulty for non-native speakers of English to master numbers (see ‘Numbers’ below), the possible threat to safety caused by controller

transmissions containing both flight level clearances and radio frequency instructions increases. This issue is a potential area for further investigation.

Conclusion

It is possible that controller message length is more of an academic concern than an existing threat to safety, with no MOR citing controller message length as contributing to miscommunication or misunderstanding. However, it is also possible that MOR forms do not provide opportunity to report this type of event.

Recommendations

- Monitor MORs for evidence of excessively lengthy controller transmissions;
- Amend MOR forms to include a tick box asking about controller message length, e.g. 'Do you feel controller message was too long? If so, why?';
- If necessary, conduct research into the optimal amount of information that controller instructions should contain. This research should incorporate non-native English-speaking proficiency issues, including problems with numbers and familiarisation with speaker prosody, including accent.

Numbers

Numbers are ubiquitous in pilot / controller communication, from identification of aircraft to flight level, and from clearances to radio frequencies. It is imperative that non-native speakers of English master the use of numbers in English. However, numbers are difficult for non-native English speakers to learn and fluently use in English (Derby, 2010; Wang, 2008, p. 160). Tiewtrakul and Fletcher (2010) found that communication errors in controller / pilot interaction in Thailand occurred significantly more often when numerical information is involved, when speakers are both non-native English, and as the complexity of messages increases.

Data

16% (44 reports) contained events whereby number confusion was evident. Of this set of reports:

- 8% (22 reports) occurred in UK airspace;
- 6% (17 reports) occurred outside of UK airspace;

- 2% (5 reports) were unclear where the event occurred.

Analysis

The analysis shows that the majority of events reported to the CAA where numbers caused confusion are call sign confusion and flight level confusion. This confusion primarily resulted in level busts (altitude deviations). Numbers are repeated back incorrectly, often one number will be substituted for another (e.g. FL260 / FL360; 4800ft / 1800ft).

The events which occurred outside of UK airspace primarily happened in Western Europe, in France, Italy, Spain, Portugal, Austria. Events also happened in Brazil and Turkey.

Several of these countries (Spain, France, Brazil) are known to be countries where language affects communication, including through multilingual radiotelephony transmissions in both local languages and English and others through a pervasive culture of substandard language proficiency.

Conclusion

Miscommunication involving the confusion of numbers happens amongst pilots and controllers, equally in UK airspace and outside of the UK. Because of the ubiquity of numbers in pilot / controller communication, the confusion and mishearing of numbers is an issue which will not disappear anytime soon. It is therefore imperative that emphasis is placed on reducing number confusion.

Recommendations

- For learners of English for aviation: make numbers and number fluency a significant focus in lessons.
- For pilots and controllers: practice hearing numbers spoken by speakers from a variety of language backgrounds, in a variety of settings that replicate real-life scenarios, including emergencies, noisy flight deck environments, and busy tower environments.

Speech rate

ICAO recommends a speech rate of 100 words per minute in radiotelephony communication (ICAO, 2010, pp. 4-12). Fast speech rate, especially of controllers,

contributes to misunderstanding, incorrect readback, and increased time on the radio to correct errors (Bieswanger, 2013; Bürki-Cohen, 1995; Hunter, 2004; Said, 2011). Indeed, repeated controller instruction, instead of spoken slower, is often spoken faster than the first utterance (Said, 2011, p. 24), contributing even more to miscommunication.

Data

1% (2 reports) reported events in which rapid rate of speech exacerbated the situation. Of this set of reports:

- 1% (2 reports) were events concerning the controller's rate of speech.

Analysis

Of the two events concerning rate of speech, one occurred in UK airspace, over Wales. [aircraft identifier removed] pilots, confused by headings issued by a UK controller, claimed that the controller spoke too quickly and failed to correct their (pilots') incorrect readback. Note that numbers also played a part in this miscommunication event. The MOR does not specify if the pilots were UK-based or from outside of the UK. The narrative mentions 'communication difficulties' but there is no reference to language proficiency issues.

The second event concerns rate of speech of an Asian departure controller, stating that departure clearance was given in poor accented English and passed in a rushed transmission. The result was that excessive time was required on the radio to clarify the clearance, thus likely reducing pilots' situational awareness. Note that accent played a part in the miscommunication in this event, though the MOR does not specify if the language proficiency of the controller also played a part.

Conclusion

Given the amount of literature on speech rate, it is surprising that only two reports are in the corpus. It could be the case that, like so many other language-related issues, events which involve rapid rate of speech are resolved and forgotten, and thus not reported to the CAA.

Recommendations

- Amend MOR forms to include a tick box or area to ease reporting of rapid rate of speech affecting communication or contributing to the event;
- Monitor MORs for further reported events where rapid rate of speech exacerbates or causes miscommunication;
- If necessary, pursue research into an 'ideal' rate of speech for UK controllers speaking with pilots with ICAO Level 4 proficiency.

6.3 ICAO / aviation language issues

In the literature review conducted for the present project, a surprisingly small amount of research on existing aviation language proficiency lessons, courses, and exams was located. This is perhaps due in part to the relatively recent implementation of ICAO Language Proficiency Requirements (LPRs) (see Alderson 2011, 2009, 2008 for further discussion of ICAO Member States and their respective implementation of language proficiency exams).

The following eight subsections briefly discuss existing research, and if and to what extent these issues are demonstrated in the MOR data.

Aviation English as lingua franca

A lingua franca 'is usually taken to mean any lingual medium of communication between people of different mother tongues, for whom it is a second language' and 'has no native speakers' (ICAO, 2010, pp. 2-6; Rimron, 2013; Seidlhofer, 2004, p. 211). English as a lingua franca (ELF) disregards normative grammatical rules, and is characterized by the frequent use of accommodation strategies to resolve misunderstandings (Kim & Elder, 2009, p. 23.14).

Characterising aviation English as a lingua franca would level the playing field, so to speak. ELF places responsibility for fluent communication in aviation English upon all participants, not just on non-native English speakers (Kim & Elder, 2009). It may therefore help to remove the 'ownership' that native English speakers feel over English and therefore aviation English (Bieswanger, 2013; ICAO, 2010, pp. 2-5; Rimron, 2013; see also 'Native English speakers using non-standard phraseology' below).

If all pilots and controllers, regardless of language background, had to 'learn' aviation English, then native speakers of English ostensibly would have to learn the same phraseology that non-native English speakers learn in aviation language courses. This would have the additional result of removing the automatic awarding of ICAO Level 6 proficiency rating to native speakers of English (Alderson, 2011). For example, while non-native English speakers must undergo standardised testing to demonstrate their proficiency in ICAO phraseology and plain language, native speakers of English are assumed to be at ICAO Level 6 proficiency, and may be evaluated by another native speaker of English (CAA, 2007), a practice which is questionable in its validity.

MORs did not address this issue, which is unsurprising given the more academic and theoretical focus of the concept of English as a lingua franca.

Recommendations

- In pilot and controller training, consider introducing the concept of English as a lingua franca;
- Train pilots and controllers to think of the English which is spoken in aviation as different to the natural English language spoken away from the aviation context;
- Emphasise to native English-speaking pilots and controllers that they are not the 'owners' of English. There is not just one 'correct' way to speak English.

Disconnect between aviation language courses / exams and real interaction

Several pieces of research commented on the disparity between aviation language lessons, courses, and exams which may contain idealised or imagined pilot/controller interaction and dialogue, and the so-called 'real' world of international civil aviation. For example, Huhta (2009, p. 26.5) notes that the test which was developed for the Finnish Civil Aviation Authority does not include 'pictures of serious accidents' in the speaking part of the test, as they may be 'too distressing' (though it is not stated if they would be too distressing for the student or examiner).

Similarly, there were ambiguities in ICAO documents concerning the teaching and evaluation of English proficiency for the aviation context. Moder and Halleck (2009, p. 25.5) note that only the ICAO LPR descriptors for vocabulary and comprehension refer to work-related topics; other descriptors refer only to general purpose proficiency. Moreover, they state that '[the ICAO Flight Safety Section] acknowledges the need to test in a context similar and relevant to the workplace. However, it then reflects concerns of some stake-holders about having non-aviation specialists evaluate radiotelephony exchanges by suggesting that phraseology tasks be restricted to warm-up or ice-breaker questions.' They argue that because of ambiguity in ICAO documents, it is essential to analyse the performance of pilots and controllers on both work-related and general English tasks in the aviation context.

Making aviation language courses and exams more realistic was suggested in several works. Farris et al. (2008, p. 408) suggest using scenarios in aviation language courses and lessons which would replicate or simulate workload conditions similar to those which students may experience on the job. Similarly, teachers of aviation language should collect and analyse discourse samples to better understand the communicative setting and develop enhanced course materials. These authentic discourse samples could also be used for awareness-raising amongst all aviation personnel in training (Kim & Elder, 2009, p. 23.15).

In their research on non-Western learners of aviation English, Kim and Elder (2009, p. 23.13) write that there should be a focus of attention in teaching syllabi tailored to the needs of non-native English speaking aviation personnel, with a special emphasis placed on the sounds which are problematic for particular groups such as the /r/-/l/ sound distinction for Korean and Japanese speakers (Wang, 2008, p. 160). It could be the case that classroom instruction supplemented with computer-based teaching and training can be most suitable for such contexts, as discussed in Wang (2007, p. 126) regarding teaching aviation English to Chinese students.

Van Moere et al. (2009, p. 27.11) argue that the highly goal-orientated, formulaic functional interactions in radiotelephony are a different kind of speech event to those in everyday communication, and language test designers must put aside previous notions of 'competence in conversational interaction'. ICAO phraseology is not, and is different to, natural, conversational English.

As one would expect, the specific issue of a disconnect between aviation English course and exam content and actual interaction was not raised in MOR data. However, symptoms of the issue can be detected in multiple MORs, such as those concerning laser incidents in non-UK airspace which resulted in non-native English-speaking controller confusion.

ICAO LPRs – below ICAO minimum language proficiency

The ICAO Language Proficiency Requirements and Language Proficiency Scale (ICAO, 2010) were developed in consultation with linguists and aviation professionals, yet have been called vague and ambiguous, and not entirely focused on aviation (occupational) uses of language (Moder & Halleck, 2009). For example, tempo is considered one marker of fluency and proficiency, which would appear to conflict with the ICAO ideal speech rate of 100 words per minute (ICAO, 2010; Said, 2011; see also 'Complexity and length of controller messages' in Section 6.2).

Moder and Halleck (2009, p. 25.5) note 'if the member states carefully read the [ICAO] manual and attend to the prefatory statements, the scales are more likely to be contextualised for the aviation domain. However, if they rely on the rating scales alone, they are more likely to focus on general English proficiency'. Alderson (2008, p. 16) questions the adequacy, stability, explicitness, and relevance of the ICAO Language Proficiency Scale, wondering if the outcome of tests constructed on their basis would be reliable and stable.

Farris et al. (2008) suggest refining the existing ICAO Proficiency Rating Scale and validating it using data from pilots and controllers under conditions of varying workload or psychological stress that would be typical of authentic pilot / controller interaction. Van Moere et al. (2009, p. 27.16) see a need for a standard-setting exercise which produces benchmark samples of the ICAO language proficiency levels, and which involves many of the available language tests so that it can be verified that standards are applied equally rigorously, and that standards do not vary over time. Prinzo and Hendrix (2008) assert that language proficiency requirements beyond the minimum specified by ICAO must be realised if communication problems are to decline.

The MORs did not contain sufficient detail about this issue. However, during the research for the present project, the researcher spoke with several teachers of English for aviation purposes working outside of the UK who spoke of their frustration over the non-compliance of some aviation professionals with ICAO LPRs, yet who possess ICAO Level 4 certificates. Many did not want to speak 'on the record', and wished to remain anonymous.

A number of countries were cited by various English teachers as places where 'sweetheart' deals can happen: ICAO Level 4 certificates are given to people who are not Level 4 proficiency. This falsification happens due to several factors, including the social and cultural norms of saving 'face' and showing respect. Certain cultures place a great deal of importance on maintaining 'face', that is, avoiding public embarrassment or humiliation which can mitigate authority, status, or hierarchical position. Learning another language can involve such embarrassment and humiliation, e.g. forgetting vocabulary, mispronunciation, or using incorrect verb forms. For some cultures, maintaining 'face' is of utmost importance, even greater than aviation safety. Additionally, an attitude widely encountered and accepted (though rarely documented) is that language-related miscommunication is not a significant risk to aviation safety, despite myriad accidents and air disasters contradicting that attitude.

This researcher has obtained documentation showing alleged evidence of cheating on an English for aviation exam in one State. It is alleged that candidates are able to pass exams after ten days' study and obtain ICAO Level 4 certificates. The teachers of English for aviation with whom the researcher has spoken have said it would be nearly impossible to go from no proficiency in English to ICAO Level 4 in such a short amount of time.

This issue is clearly an area of concern and it is not known how widespread the issue may be.

Recommendation

- Investigate the type and extent of inappropriate tuition and granting of proficiency awards with the purpose of driving towards better standards.

ICAO phraseology

ICAO phraseology (ICAO, 2010; 2007) is a highly prescribed, specialised code, developed to ensure effective and efficient communication, and to reduce ambiguity and misunderstanding as much as possible. However, it is evident that not all persons in civil aviation use (or are proficient in) ICAO phraseology to the minimum standard set out in ICAO (2010), i.e. Level 4.

The literature reviewed for the first report shows that there is a lack of adherence to ICAO standards, including phraseology and phonetic alphabet. Pilot respondents to a 2011 IATA-conducted survey report that this lack of adherence to ICAO standards is a significant condition causing confusion amongst pilots (Moder, 2013; Said, 2011, p. 19; Sullivan & Girginer, 2002; van Es, 2004). In the same survey, non-standard phraseology, especially in the US, was cited by pilots as a common practice which creates a threat (Said, 2011, p. 26). The recommendation by Prinzo et al. (2010d) that controllers be discouraged from using local jargon, slang, idiomatic expressions, and other forms of conversational communications when transmitting to pilots indicates that ICAO phraseology is not always used in pilot / controller communications. Brazilian pilots and controllers report that non-standard phraseology is a possible cause of misunderstanding which could affect pilot / controller communication (Monteiro, 2012, p. 62).

There is a disparity between ICAO phraseology and some national standardised variations, especially the US / FAA, contributing to misunderstanding and miscommunication (Prinzo, et al., 2010a; Said, 2011, p. 49). Indeed, a mixture of ICAO, FAA, and other phraseologies is taught and used in Korea (Kim & Elder, 2009, p. 23.3). There are some disparities between CAA standard phraseology and ICAO standard phraseology (CAA, 2015).

It should be noted that problematic communication occurred more frequently in the messages of pilots and controllers following a deviation of radiotelephony protocol than when responding to a non-deviant message (Howard, 2008, p. 383). Thus, deviation from ICAO phraseology can result in misunderstanding, confusion, increased time on the radio to clear up confusion, miscommunication, and ultimately a threat to safety.

Data

6% (16 reports) cite events whereby the use of non-standard phraseology caused miscommunication or contributed to the event. Of this set of reports:

- 2% (6 reports) occurred in UK airspace;
- 4% (10 reports) occurred outside of the UK.

Analysis

The analysis shows that, of the events occurring in UK airspace reported to the CAA in which non-standard phraseology was noted, no event occurred at either London-Heathrow or London-Gatwick. Two events were reported as occurring at Glasgow, one whereby ATC used non-standard phraseology and one whereby a ground headset operator allegedly used non-standard communication; the operator also did not read back any flight crew instructions. Note the use of the mitigating term 'allegedly'; see Section 5.5 for further discussion of this phenomenon.

All events where non-standard phraseology was reported that occurred outside of the UK were reported to have been committed by either air or ground controllers. Non-standard phraseology was reported to be used by controllers in a wide variety of countries around the world with not enough information to identify any regions of particular concern. The most common type of non-standard phraseology used was concerning aircraft readiness for departure.

Conclusion

ICAO phraseology is considered by some researchers to be inadequate for non-routine events, resulting on an over-reliance on plain language in highly stressful situations. Lack of proficiency in plain language can contribute to the stress of a non-routine event. Research has called for ICAO phraseology to be expanded to cover a broader range of situations and uses (Kim & Elder, 2009, p. 23.15).

However, according to the data, non-standard phraseology represents a smaller concern for UK pilots and controllers than other issues (e.g. call sign confusion). It could be the case that some non-standard phraseology concerns have more impact on aviation safety than others. Phraseology which is ambiguous outside of the country in which it is used could be a significant threat to aviation safety, if not all

persons share the meaning of such an ambiguous phrase. For example, the phrase 'What kind of service do you require?' (used by some UK FISOs and controllers) may not be understood by non-UK pilots, causing confusion.

Recommendations

- Synthesise CAA standard phraseology with ICAO standard phraseology as much as possible;
- Publicise CAA phraseology where it differs from ICAO standard phraseology.

Oversight, regulation and assessment of aviation English courses and exams

In order to be licensed to operate in international civil aviation, pilots and controllers must demonstrate proficiency in English to the minimum standard set out by ICAO (2010). In most circumstances this proficiency will be determined by exams which are approved by the civil aviation authorities of ICAO Member States.

National civil aviation authorities vary in their ability and competence to judge reliability of aviation English test quality (Alderson, 2011; 2009; 2008). Alderson (2008, p. 1) argues that 'monitoring is required of the quality of language tests used in aviation to ensure they follow accepted professional standards for language tests and assessment procedures'.

There now exists the Aviation English Language Test Service (AELTS), administered by ICAO, which assess tests of English for aviation. The AELTS is intended to identify and formally recognise tests of aviation English which meet ICAO LPRs. Tests that are assessed and found to fully conform with ICAO LPRs and follow good language testing practices receive a certificate, valid for three years, which test providers are encouraged to publicly display. Additionally, ICAO publicly identifies such fully conforming tests on their AELTS website.

There are a few concerns to note about the AELTS. It is not a required service; tests of English for aviation do not have to undergo assessment in order to be administered. Thus, it is not known how many tests of English for aviation actually do conform to ICAO LPRs and follow good language testing practices (Alderson, 2009;

2008; Moder & Halleck, 2009; Read & Knoch, 2009). Moreover, the financial, organisational, and administrative costs of having a test assessed by AELTS could deter some test providers from using this service.

Finally, while ICAO provides an assessment service for aviation English tests, there is not a similar central organisation which has oversight or approval of schools offering aviation English courses, lessons, and instruction. Proficiency in ICAO phraseology and plain language does not come solely from tests. Language proficiency results, in part, from lessons which inspire students to learn, teachers who assist students in learning via the students' most appropriate methods, and schools which create an environment suitable for language learning (ICAO, 2009a). A service similar to AELTS for aviation language schools could assess these and other factors which contribute to language proficiency.

Due to the academic and theoretical focus of this issue, it is unsurprising that it is not explicitly addressed in MOR data.

Native English speakers using non-standard phraseology

According to ICAO (2010), "Native speakers may be perceived as the 'owners' of a language through whom ultimate standards for proficiency are set" (ICAO, 2010, pp. 2-5). However, 'native speakers may lack the vocabulary to discuss certain themes or may speak with a regional accent that is an impediment to intelligibility for those from outside that region. They may fail to take into account or use appropriate sociolinguistic differences in register. They may be inefficient users of the language in terms of their pragmatic competence' (ICAO, 2010, pp. 2-5).

Many researchers have cited the risk to aviation safety posed by native English speakers' non-adherence to ICAO phraseology, frequent use of jargon, slang, non-standard phraseology, and overreliance on plain language (Bieswanger, 2013; Kim & Elder, 2009; Moder, 2013; Prinzo & Hendrix, 2009; Said, 2011). A 2011 IATA survey of international pilots and controllers notes that many pilot respondents from non-English-speaking countries observed that controllers in English-speaking countries have a tendency to speak fast, use local phrases, slang, or non-ICAO phraseology, making it difficult for the pilots to understand (Said, 2011, p. 31). Said (2011) goes on

to specify that a significant number of North American (i.e. Canadian and American) pilots and controllers do not adhere to or use ICAO phraseology.

Native English speakers often do not have to undergo tests of their knowledge of ICAO phraseology and language proficiency. Instead, native English speakers are frequently automatically granted or assessed at ICAO Level 6 (Alderson, 2009, p. 181; CAA, 2007).

ICAO phraseology more broadly is discussed in 'ICAO phraseology' above. The current section discusses only those events which are reported to have occurred in UK airspace.

Data

2% (4 reports) cite events which occurred in the UK whereby non-standard phraseology was used. Of this set of reports:

- 1% (2 reports) are events where controllers are reported as using non-standard phraseology;
- 1% (2 reports) are events where ground staff (i.e., not controllers) are reported as using non-standard phraseology.

Analysis

The analysis shows that, of the events occurring in UK airspace reported to the CAA in which non-standard phraseology was noted, no event occurred at either London-Heathrow or London-Gatwick. Two events were reported as occurring at Glasgow, one whereby ATC used non-standard phraseology and one whereby a ground headset operator allegedly used non-standard communication; the operator also did not read back any flight crew instructions. Note the use of the mitigating term 'allegedly'; see Section 5.5 for further discussion of this phenomenon.

Events involving non-standard phraseology used by UK controllers resulted in an airprox wherein separation between an A340 and A321 was lost; a second MOR cites lack of coordination between Glasgow and Scottish West Coast ATC during handover. In the handover event, the MOR is not specific if pilots involved were UK-based or from outside of the UK.

In the airprox event, language-related miscommunication exacerbated the situation, with the A321 pilot's accented readback, along with the controller's bias to hear what he was expecting to hear, causing the controller to accept an incorrect readback as correct. Resulting avoiding action phraseology was non-standard.

Events involving ground staff using non-standard phraseology resulted in a takeoff clearance being cancelled due to a runway vehicle obstructing a runway (London City), and an incorrect pushback due to ground headset operator's use of non-standard communication and not reading back any of the flight crew's instructions.

Given the amount of literature on native English speakers using non-standard phraseology, it is surprising that so few MORs in the corpus report such events. It could be the case that events in which native English speakers using non-standard phraseology go unnoticed or are forgotten about after their resolution.

It could also be the case that native English speakers are not aware of their use of non-standard phraseology, for example because they believe they are using correct phraseology. Another explanation is that native English speakers feel that non-standard phraseology is appropriate to use in radiotelephony communication, when in fact standard phraseology would not only be appropriate to the situation but would be used by non-native English speakers who undergo more training in the use of phraseology than do native speakers of English.

Conclusion

Without data, it is difficult to know the extent to which native English speakers use non-standard phraseology, and to what extent this use contributes to pilot / controller miscommunication.

Recommendation

- Amend MOR forms to include a tick box regarding use of ICAO standard phraseology, e.g. 'Did non-standard phraseology play a part in the incident or in miscommunication?'

Non-routine radiotelephony messages

Due to the lack of ICAO phraseology to use in non-routine events, speakers must rely on plain language knowledge and proficiency (Linde, 1988; Moder, 2013; Koble

& Roh, 2013); see 'Plain language versus ICAO phraseology' below for discussion of plain language. As discussed in 'ICAO phraseology' above, many academics and aviation safety researchers feel that ICAO phraseology needs to be developed and expanded to cover non-routine situations.

However, not all non-native English speakers are proficient in plain language to the level necessary for efficient and effective communication in non-routine events. Prinzo et al. (2010b) note that when non-routine events occur, non-native English-speaking controllers have difficulty communicating in plain language, and US native English-speaking pilots have difficulty understanding them.

Data

6% (15 reports) cite events where there was miscommunication between pilots and controllers due to non-routine events. Of this set of reports:

- 2% (4 reports) occurred in UK airspace between non-UK pilots and UK controllers;
- 4% (11 reports) occurred outside of the UK between UK pilots and non-UK controllers.

Analysis

The data show that laser attacks are the most reported non-routine event causing miscommunication or misunderstanding between UK pilots and non-UK controllers. These events occurred outside of UK airspace, in Casablanca, Milan, Madrid, and Sharm El Sheikh. Events occurred both in climb and descent / approach. In all events, ATC did not understand the nature of the report by UK pilots. In one event, UK pilots themselves warned other aircraft on frequency about the attack. The Madrid event required another aircraft to translate the event to the Spanish controllers.

Other non-routine events occurring outside of UK airspace which non-UK controllers did not understand mechanical incidents; windshear; medical emergency; TCAS RA; and taxiway infringement.

Events which took place in UK airspace resulted in airspace infringement; altitude deviation; and excessive time on radio attempting to resolve an incorrect clearance due to non-UK pilots' lack of understanding of controller instructions.

Misunderstanding due to non-routine events occurred in climb, cruise, and descent phases of flight. Two events occurred in the London area; one in SIDVA waypoint, and one near Birmingham.

Conclusion

Non-routine events can create misunderstanding and cause miscommunication between native and non-native speakers of English due to several factors: no standard phraseology exists for the non-routine event; reporters must rely on plain language to communicate the event. Plain language can involve being 'too wordy' (using too many words that are irrelevant to the situation). Speakers who do not share the level of fluency or understanding of plain language may not understand the reported non-routine event, causing even more stress than what already is occurring at the time of the report.

Recommendations

Pilots and controllers

- Include in training non-standard events which require reporting. Recreate as closely as possible real-life environments, including noisy flight deck, poor radio reception, and busy tower environment;
- Train to reduce or eliminate extraneous words when reporting non-routine events. Report only the essential information; do not give a narrative.

ICAO

- Work with ICAO to expand standard phraseology to include such non-routine events as laser attacks and medical emergencies.

Non-native speakers of English

- On ICAO language proficiency exams, include non-routine events and recreate as closely as possible real-life environments, including noise flight deck, poor radio reception, and busy tower environment.

- *Safety Assessments of Foreign Aircraft (SAFAs)*
  - Include in SAFAs questions to assess pilots' proficiency in plain language as well as phraseology. Follow up with appropriate authorities when lack of proficiency is assessed.

Plain language versus ICAO phraseology

ICAO defines plain language in aeronautical radiotelephony communications as 'the spontaneous, creative, and non-coded use of a given natural language, although constrained by the functions and topics (aviation and non-aviation) that are required by aeronautical radiotelephony communications, as well as by specific safety-critical requirements for intelligibility, directness, appropriacy, non-ambiguity, and concision' (ICAO, 2010, pp. 3-5).

Plain language is an important part of language proficiency, and is required in both everyday situations and non-routine events in aviation (ICAO, 2010, pp. 3-5). Plain language is frequently used in emergency and non-routine situations, especially by native English-speaking pilots and controllers (Kim & Elder, 2009, p. 23.14; Linde, 1988; Koble & Roh, 2013; Moder, 2013); see also 'Non-routine radiotelephony messages' above.

The data did not explicitly refer to the issue of plain language causing misunderstanding or miscommunication. This could be due to the nature of the MOR submission process: there may be little or no space to report incidents of language-related miscommunication. Additionally, it could be due to MOR reporting culture, e.g. lack of awareness that such plain language / ICAO phraseology issues are reportable events. It could also be the case that once the event occurs and is resolved, it is forgotten, and therefore is not reported.

Recommendation

- Increase awareness of language-related miscommunication events amongst UK aviation staff, especially the need to report language-related miscommunication events.

6.4 Linguistic issues

The following four subsections discuss technical linguistic concepts which can contribute to misunderstanding. These issues can combine with other non-linguistic problems, e.g. noisy flight deck environment, poor radiotelephony equipment, fast speech rate, and unfamiliar or incomprehensible speaker accent, resulting in increased confusion, misunderstanding, and miscommunication.

Ambiguity

Words with uncertain or ambiguous reference (e.g. ‘him’, ‘it’, ‘things’) can lead to misunderstanding and miscommunication (Cushing, 1995, p. 4; Cushing, 1994; Howard, 2008). Ambiguous language was an issue in the 1972 Eastern Airlines 401 crash in the Florida Everglades whilst on descent into Miami International Airport (MIA). The flight crew were having problems with their nose gear; MIA approach controllers noticed their altitude was decreasing without authorisation. Controllers asked ‘How are things comin’ along up there?’ The flight crew understood ‘things’ to refer to the nose gear problems; controllers meant ‘things’ to refer to the unscheduled changes in altitude.

Data

2% (4 reports) cite events where ambiguity is noted. Of this set of reports:

- 1% (3 reports) occurred in UK airspace;
- 1 report occurred outside of the UK.

Analysis

The data show that of the events which occurred in UK airspace, two were between UK controllers and non-UK pilots who were not native speakers of English. Ambiguity events occurred on the ground and on climb. Results of the ambiguous interaction in UK airspace were infringement of Class D airspace by a PA28; failure to hold position during taxi; and commencement of take-off run without clearance.

One event occurred at London-Heathrow which involved the ‘green light’ system: the controller instructed an A340 to ‘follow the greens’. This instruction contained insufficient information for the A340 to correctly taxi. In research for this project, this

'follow the greens' system was cited by informants as causing misunderstanding and miscommunication with pilots who are not familiar with the system.

The single event which occurred outside of the UK involving ambiguity happened in Algiers during taxi. ATC clearance was 'allegedly' ambiguous, resulting in a [identifier removed] entering R/W05 without clearance. Note the use of the mitigating term 'allegedly'; see Section 5.5 for further discussion of this phenomenon.

Conclusion

Given the amount of literature in both linguistic and human factors research, it is surprising that only four reports citing ambiguity were in the corpus. It could be the case that more events involving ambiguous communication have occurred but were never reported, for a variety of reasons, including reporters forgetting the event once it is resolved.

Recommendation

Amend MOR forms to include a tick box to report suspected ambiguous communication, e.g. 'Did the event involve ambiguous communication? If so, by whom?'

Homophony

Homophony refers to words and phrases which sound alike (e.g., 'to' and 'two') or nearly alike (e.g., 'west' and 'left') (Cushing, 1995; Cushing, 1994; Howard, 2008; Philps, 1991; Said, 2011). ICAO phraseology works to eliminate the majority of homophones in aviation radiotelephony; however, it is unlikely that homophony will ever be fully eliminated in pilot / controller communication. The potential for misunderstanding can increase due to poor quality radiotelephony equipment, noise, radio frequency interference, or other equipment issue; fatigue; stress; or other factors.

Data

16% (44 reports) cite events wherein some evidence of homophony occurred. Of this set of reports:

- 10% (26) occurred in UK airspace;
- 5% (13) occurred outside of the UK;

- 2% (5) were unclear where the event occurred. Note that percentages are rounded up, hence the discrepancy in addition.

Analysis

While numbers spoken by native speakers of English may not sound like homophones, numbers spoken in non-native accented English can create homophones. Noisy flight deck environments and poor quality radio frequency can also impede correct interpretation of utterances and contribute to homophone creation.

The data show that the majority of homophone events involved the mishearing of similar sounding numbers. Call signs especially created homophones, with 9% (23 reports) constituting homophony via similar sounding call signs (e.g. 377 / 477; JS41 / PA31; 1557 / 6551). Homophones were also created from similar-sounding waypoints; these are discussed in ‘Hearer expectation’, Section 6.1.

The most common result from mishearing transmissions and instructions due to homophony was altitude deviation.

The data show that language proficiency and language-related miscommunication were factors in two homophony events which occurred inside UK airspace. Of these two events, both involved heavily accented speech of pilots. MORs do not contain sufficient amount of detail to know the origin of pilots (i.e. UK-based or from outside of the UK) who were involved in homophony events in UK airspace. Some narratives provide additional information about pilots; this detail was the only way to interpret if pilots were UK-based or from outside the UK.

Of the homophony events which occurred outside of the UK, five involved language proficiency issues and language-related miscommunication. MORs cite accented controller speech as contributing to the miscommunication in four of the five events; ‘poor communications with ATC’ is cited in the fifth.

Note the involvement of numbers with homophone creation. Non-native English accented speech, noisy flight deck environment, and poor quality radio frequency are all factors which can affect interpretation of numbers, and contribute to misinterpretation. ‘Numbers’, Section 6.2 contains further discussion of numbers.

Conclusion

Several factors contribute to the creation of homophony in pilot / controller communication. The two most significant factors as supported by the data are non-native accented English and similar-sounding call signs. Homophony creation is further likely in noisy flight deck environments or in poor quality radio transmissions.

Recommendations

- Train pilots and controllers to read back transmissions about which they are unsure, or which may have been misheard;
- In pilot and controller training, highlight how homophones can be created through routine radiotelephony interaction;
- Train both native and non-native speakers of English to enunciate numbers. Underscore the importance of adhering to ICAO number pronunciation and speaking standards, e.g. say every number individually;
- Setting a minimum standard of quality for radiotelephony equipment may help reduce homophone creation.

Modals

Modals (e.g. ‘can’, ‘could’, ‘may’, ‘might’, ‘must’, ‘shall’, ‘should’, ‘will’, ‘would’) are a type of (auxiliary) verb which indicate modality, such as likelihood, permission, ability, or obligation. Modal verbs create conditional situations which are open to interpretation. Such interpretation is dependent on participants in communication sharing norms of interpretation. For example, a controller stating ‘I can offer you XX flight level’ can be interpreted in more than one way: (1) The controller is providing a choice to the pilot but not guaranteeing the availability of the flight level, merely the option; (2) The controller is actually giving the pilot the new flight level (Cushing, 1995).

Modal verbs are frequently used in plain language and conversational English; thus modals are used more in emergency and non-routine events than during routine events (Koble & Roh, 2013, p. 51). The use of modals (especially ‘could’) can also be a strategy to effectively accomplish cooperative actions (Moder, 2013, p. 238).

The MOR analysis did not contain sufficient detail to determine if the use of modal verbs by either UK pilots or UK controllers contributed to language-related

miscommunication or misunderstanding. It may be worth incorporating this issue into future research on pilot / controller miscommunication and aviation safety.

Prosody

Prosody 'encompasses the full range of the aural signal in human speech, including frequency, pitch, intonation, loudness, rhythm, duration, pauses, and phrasing' (Hunter, 2004, p. 129). Prosody provides language-enhancing information and cues that signal meaning, including emotional and expressive information that adds context and meaning to an utterance (Cushing, 1995; Cushing, 1994; Hunter, 2004; Monteiro, 2012, p. 62; Prinzo, et al., 2010b).

Differences in prosody, intonation, and pauses can influence meaning or misunderstanding (e.g. 'back … on the power' versus 'back on … the power'). These differences can stem from differences in communication expectations between English and the native languages of non-native English speakers. Indeed, prosody's subtle cues may be processed beneath one's consciousness, offering opportunities for gender-based preconceptions and cross-cultural misunderstandings (Hunter, 2004, p. 129). Bilingual speakers of English transfer some prosody from their first languages, as well as cultural markers such as politeness, directness, and other subtle interpersonal cues (Hunter, 2004, p. 143).

Non-native accented English will almost certainly have different prosody than native English varieties, and will require some period of adjustment for hearers to attune to the different prosody. See 'Accents' in Section 6.2, for further discussion of accents.

6.5 Socio-cultural issues

The final section is devoted to issues which stem from primarily social and cultural factors. While communication does not happen in a vacuum, most pilot / controller communication occurs within a highly regulated and controlled context, in regular patterns, and at predictable phases of flight. However, pilots and controllers working in international civil aviation are individuals and come from many different societies and cultures. As such, they have different norms of communication, interaction, and interpretation which are difficult to eliminate in radiotelephony communication, despite the great deal of training and regulation present in civil aviation.

Language and cultural awareness

Cultural differences exert an important yet nearly undetectable influence on international aviation (Prinzo & Campbell, 2008). For example, in her research on Brazilian pilot/controller interaction and communication, Monteiro (2012, p. 63) notes that 'some categories which were classified as pertaining to the group of linguistic factors (e.g. qualitative information in speech, lack of familiarity with native or non-native accent, language barriers, etc.) or to the group of discursive-interactional factors (e.g. pilot reluctance to declare emergency, saving face, power relations, etc) are also culturally influenced, either by the national culture of the participant or by his / her professional or organisational cultures'. She argues that the relationship between Brazilian pilots and controllers appeared in her data to be fragile and with a certain rivalry in the air (Monteiro, 2012, p. 62).

Lack of language awareness, intercultural awareness, and sensitivity can influence the efficiency and efficacy of pilot / controller communication (Bieswanger, 2013; Bratanić, 1999; de Matteis, 2012; Estival & Molesworth, 2009; Kim & Elder, 2009). For example, non-native English-speaking pilots interacting with non-native English-speaking controllers have the highest probability of miscommunication and misunderstanding (Said, 2011; Tiewtrakul & Fletcher, 2010). These problems in understanding and communication could be due to inherent differences of speakers' native languages and cultures (Tiewtrakul & Fletcher, 2010, p. 238). Unawareness of the norms of communication, interaction, and interpretation of participants in interaction can also influence understanding and contribute to confusion.

The analysis revealed that MOR narratives are lacking in sufficient detail to understand if cultural issues have an influence on pilot / controller communication and aviation safety. It is very likely that cultural influences do affect communication between pilots and controllers, and it could be the case that language-related miscommunication is exacerbated by cultural issues. Because aviation will remain a global industry, it is important to understand the extent to which cultural factors play a part in miscommunication between pilots and controllers.

Recommendation

- Incorporate cultural factors in future research on language-related miscommunication between pilots and controllers. This could involve ethnography, questions in surveys or interviews, or some other means.

Politeness

Politeness is often socially and culturally determined; what is considered polite in one culture is not necessarily deemed to be polite in others. For example, in some cultures interruption is considered an acceptable and valued part of interaction, signifying solidarity, community, and friendliness. Other cultures consider interruption to be a sign of rudeness, showing a lack of consideration for the speaker who is interrupted.

Politeness markers (e.g. ‘please’, ‘thank you’), and the concept of politeness more broadly, are not inherent in ICAO phraseology. Indeed, politeness is considered to be less valued in pilot / controller interaction using ICAO phraseology; direct utterances are more communicatively successful than mitigated utterances (Linde, 1988; Van Moere, et al., 2009). Yet politeness markers still appear in radiotelephony communication, including greetings (e.g. ‘hello’, ‘good morning’), closings (e.g. ‘so long’, ‘good night’), and other markers (e.g. ‘sir’, ‘please’, ‘thank you’) (Howard, 2008; Moder, 2013, p. 231; Sullivan & Girginer, 2002).

Use of politeness markers typically occur when pilot / controller communication does not go according to expectations, and serves to acknowledge ‘face’ needs of others and mitigate any potential personality clash or insult (Moder, 2013, p. 233). Monteiro (2012, p. 63) notes that in Brazilian pilot / controller interaction, the preoccupation of ‘saving face’ and not feeling threatened or humiliated comes from pilots, who – according to their responses in her data – consider themselves to be superior to controllers. When a speaker is perceived to be impolite or rude, miscommunication can happen (Bieswanger, 2013; de Matteis, 2012; Linde, 1988).

On the surface, politeness markers would not appear to be an issue in international civil aviation radiotelephony communications, as ideally the communication would be in English, in which all participants would be proficient. However, there is often a

difference between the idealised world of manuals and training, and the reality of international radiotelephony communication.

One problem with the use of politeness markers in pilot / controller communication is that greetings and closings often happen in local (non-English) languages, which can interfere with situational awareness (Sullivan & Girginer, 2002, p. 401; see also 'Code-switching and bilingualism in radiotelephony – reduction of pilot sutuational awareness due to multiple languages on the radio' in 6.2). Politeness markers can also be slang, taboo, local, or regional; as such their meanings and situationally appropriate interpretations may not be shared by all participants in communication. Another factor about politeness markers is that participants in interaction can feel insulted if something goes wrong, for example if a politeness marker is misinterpreted. Feelings of insult and upset can be distracting, and reduce situational awareness, creating a threat to aviation safety.

The analysis reveals that MORs are not detailed enough to understand the role that politeness plays, if at all, in miscommunication between pilots and controllers. Given the ubiquity of politeness markers in all human languages, it is likely that this area is a potential place where misunderstanding or miscommunication could happen. Indeed, politeness markers appear in many of the MOR narratives in the reporting of apologies by pilots or controllers for various reasons.

The analysis did reveal two events, classified under 'Other Miscommunication', wherein some social or cultural norm appears to have been violated:

- ******007, Palma de Mallorca: reporter alleges that an [identifier removed] disregarded ATC instructions to give way to XXX (reporter); [identifier removed] claim they did not hear ATC instructions. Note use of the mitigating term 'alleges'; see Section 5.5 for further discussion.
- ******166, FCO: XXX pilot used 'inappropriate language' over RT directed at slowed [identifier removed] (reporter) which was distracting to [identifier removed] crew during critical phase of flight.

Recommendation

- Incorporate awareness of politeness markers into future research on miscommunication between pilots and controllers.

Chapter 7

Findings from MOR analysis not discussed in literature review

The MOR analysis revealed two issues which were not raised in the literature review: prolonged loss of communication and left / right confusion. Each is discussed below.

7.1 Prolonged loss of communication

Prolonged loss of communication (PLOC) events are events wherein pilots are out of communication with ATC for an extended period of time. These loss of communication events should not happen; pilots are required to check in via radiotelephonic communication with controllers at specified times and waypoints along their routes of flight.

Data

8% (22 reports) cite events whereby there was a loss of pilot communication with controllers or pilots did not check in with controllers when they were supposed to. Of this set of reports:

- 3% (7 reports) occurred in UK airspace;
- 4% (11) occurred outside of the UK;
    - 3% (7 reports) occurred in French airspace;
- 2% (4 reports) are unclear where the event occurred.

(Note that percentages are rounded up; hence the discrepancy in percentages.)

Analysis

Prolonged loss of communication events which occurred in French airspace ranged in time from pilots missing ATC calls 4 times to being out of contact with ATC for 35 minutes. In a PLOC event in Marseilles the aircraft was nearly intercepted by the French military. Contact was eventually re-established with ATC, though the

narrative is unclear if it was French or UK ATC. Multilingual radiotelephony in French and English was cited in three PLOC events occurring in French airspace.

Of the PLOC events reported to have occurred in UK airspace, three occurred in London area airspace (LHR, LGW, and STN). Four events involved non-UK pilots, three of which cite substandard language proficiency or other language issues as contributing to the loss of communication. One event resulted in a UK military intercept and escort.

Conclusion

It is clear that language, including substandard language proficiency, is a factor in some prolonged loss of communication events. Multilingual radiotelephony environments and substandard language proficiency are the most significant contributing factors to PLOC according to the data.

Recommendation

- Include in pilot checklists that pilots must verify that ATC has been contacted at every point where communication is required.

Left / right confusion

Data

1% (2 reports) cite events where the terms ‘left’ and ‘right’ have created confusion. Of this set of reports:

- One event occurred in Rio;
- One event occurred in UK airspace, on approach to Manchester.

Analysis

In the event in Rio, the reporter states that ATC instructions were confusing due to the controller’s incorrect use of ‘left’ and ‘right’. The event resulted in a foreign airprox, with the [identifier removed] receiving and complying with a TCAS RA climb with conflicting traffic climbing from below. The MOR narrative also cites concerns about proficiency of English language.

In the Manchester event, an A320 was being vectored for R/W05 with no mention of left or right by the previous sector. ATIS information and Tower reports conflicted.

The MOR does not specify if the pilot involved was UK-based or from outside of the UK.

Conclusion

Confusing right and left can result in an accident; at the very least such confusion results in excessive radio transmissions and reduced situational awareness whilst attempting to resolve the confusion. Given that many UK and international airports operate parallel runways, understanding the difference between left and right is crucial in aviation.

Recommendation

- In English for aviation lessons, emphasise the importance of expressing and understanding the difference between right and left.

Chapter 8

Conclusions and future work

The analysis has revealed a number of issues of importance to safety. Perhaps most significantly, MOR reporting culture with respect to language issues requires enhancing the level of detail. Greater emphasis should be placed on reporting events in which language proficiency or language-related miscommunication is a factor.

Moreover, the analysis has supported the assertions made by numerous aviation safety professionals and teachers of English for aviation that minimum levels of language proficiency as set out by ICAO Document 9835 (ICAO, 2010) are not fully present in international aviation. There are many reasons for this lack of proficiency, some of which have been discussed in this document. A next step would be to work to lessen or eradicate barriers to language proficiency in non-native English-speaking controllers and pilots. For the safety of the UK travelling public, it is imperative that all pilots and controllers working in international aviation have the proficiency to communicate clearly and succinctly in all situations, routine and non-routine.

Language-related miscommunication, including lack of ICAO proficiency standards, certainly has the potential to be the cause of serious incidents or even accidents. Several MORs that reported language-related miscommunication had the potential to develop into serious incidents or accidents.

Thus far, training and multiple layers of safety precautions appear to have deterred serious incidents or accidents where language proficiency or language-related miscommunication played a part. However, we cannot rest on our laurels. We must be vigilant and proactive with language-related miscommunication and ICAO language proficiency standards, however difficult it may be. We must consider language proficiency to be as important to aviation safety as any other factor in aviation.

This research should be continued, with the next phase to focus on gathering original data from pilots and controllers.

Appendix A

Best practice recommendations

8.1 CAA-actionable issues

Mandatory Occurrence Reports (MORs)

- Include a greater amount of detail in MOR narratives which centre on or involve language-related issues.
- Emphasise the importance of reporting language-related miscommunications and misunderstandings. Clarify that ‘language-related’ can include accents, dialects, poor English skills, and any other issue that is related to communication and interaction.
- Improve reporting culture and practice with respect to language-related incidents. Especially emphasise the importance of reporting explicitly and specifically what miscommunication or misunderstanding happened as a result of poor language proficiency. Note that ‘some language issues’ and similar phrases is inaccurate, too vague, and not detailed enough to allow the CAA to better understand the number and details of incidents related to poor English language proficiency.
- Increase awareness of language-related miscommunication events amongst UK aviation staff, especially the need to report language-related miscommunication events.
- Increase vigilance in reporting incidents involving non-native English accents and miscommunication at UK airports.
- Increase awareness of the CHIRP reporting scheme amongst UK inflight crew, controllers, and mechanics, including the emphasis on the reporting of language-related incidents.
- Have a discrete section or tick box on MOR forms for language-related miscommunication, e.g., ‘Do you believe that language proficiency contributed to, exacerbated, or caused this incident?’

- Amend MOR forms to include a tick box or space to record if participants in the event are UK-based controllers or pilots.
- Amend MOR forms to include a discrete tick box on MOR forms for language-related miscommunication as a factor in reported events.
- Amend MOR forms to include a tick box asking about controller message length, e.g., 'Do you feel controller message was too long? If so, why?'
- Amend MOR forms to include a tick box or area to ease reporting of rapid rate of speech affecting communication or contributing to the event.
- Amend MOR forms to include a tick box regarding use of ICAO standard phraseology, e.g., 'Did non-standard phraseology play a part in the incident or in miscommunication?'
- Amend MOR forms to include a tick box to report suspected ambiguous communication, e.g., 'Did the event involve ambiguous communication? If so, by whom?'
- Monitor MORs for waypoint confusion events and take action if necessary.
- Monitor MORs for language-related miscommunication in readback-hearback errors both inside UK airspace and outside of the UK.
- Monitor MORs for evidence of excessively lengthy controller transmissions.
- Monitor MORs for further reported events where rapid rate of speech exacerbates or causes miscommunication.

Safety assessments of foreign aircraft

- Include in SAFAs questions to assess pilots' proficiency in plain language as well as phraseology. Follow up with appropriate authorities when lack of proficiency is assessed.

UK-based ground staff language proficiency

- Implement a standard level of English language proficiency for all ground staff, including tug drivers, ground crew, pushback crew, catering, and baggage loading staff.

- English language proficiency spot checks can be conducted along with or in the same manner as SAFAs.

CAA phraseology

- Synthesise CAA standard phraseology with ICAO standard phraseology as much as possible.
- Publicise CAA phraseology which differs from ICAO standard phraseology.

Radiotelephony equipment

- Set a minimum standard of quality for radiotelephony equipment, including headsets and microphones, for commercial aircraft operated by UK airlines.
- Monitor radiotelephony communications inside of the UK for quality.

8.2 Aviation English lessons, courses and exams

- Include in aviation English classes training to understand different accents heard in English, including so-called 'native' varieties (e.g. Indian English, South African English) as well as non-native speaker varieties (Koble & Roh, 2013, p. 51).
- Address variations in intonation, rhythm, and pauses that native and non-native English speakers have (Estival & Molesworth, 2009, p. 24.5; Koble & Roh, 2013, p. 51; Moder, 2013, p. 235).
- In teaching syllabi tailored to the needs of non-native English speaking aviation personnel, focus attention on core features of pronunciation, including initial consonants, that need to be mastered for mutual intelligibility between English users from different native language backgrounds (Koble & Roh, 2013, p. 51; Said, 2011, p. 21).
- In English for aviation lessons, make numbers and number fluency a significant focus.

- In English for aviation lessons, emphasise the importance of understanding the difference between right and left.
- On ICAO language proficiency exams, include non-routine events and recreate as closely as possible real-life environments, including noise flight deck, poor radio reception, and busy tower environment.
- Encourage investigation of the type and extent of inadequate training and inappropriate awards that happens in English language proficiency exams.

8.3 Pilots and controllers

- A core part of the training of all pilots and controllers should involve training in the use of communication strategies to facilitate successful and efficient communication with speakers from diverse language backgrounds.
- Such strategies could include simplification of speech and avoidance of redundant information, paraphrasing of utterances when these are found to cause problems of comprehension, and more judicious deployment of available language resources, including the existing aviation phraseology repertoire (Kim & Elder, 2009, p. 23.15; Koble & Roh, 2013, p. 48; Moder, 2013, p. 240).
- Native English-speaking pilots and controllers should train in use of ICAO phraseology in situations of stress. Training scenarios should replicate as much as possible real-life scenarios (Moder, 2013).
- Train to pause between ‘chunks’ of information (Cushing, 1995; Howard, 2008, p. 386).
- Train to not speed up rate of speech in periods of high stress (Said, 2011, p. 24).
- Increase awareness amongst UK pilots and controllers of language-related miscommunication in readback-hearback errors.
- Include in pilot and controller training familiarisation with non-native English-speaking accents. Replicate real-life conditions in training

conditions, e.g., include noisy flight deck environment, poor sound quality, busy tower environment.

- Practice hearing numbers spoken by speakers from a variety of language backgrounds, in a variety of settings that replicate real-life scenarios, including emergencies, noise flight deck environments, and busy tower environments.
- In pilot and controller training, consider introducing the concept of English as a lingua franca.
- Train pilots and controllers to think of the English which is spoken in aviation as different to the natural English language spoken away from the aviation context.
- Emphasise to native English-speaking pilots and controllers that they are not the ‘owners’ of English. There is not just one ‘correct’ way to speak English.
- Train pilots and controllers to read back transmissions about which they are unsure, or which may have been misheard.
- In pilot and controller training, highlight how homophones can be created through routine radiotelephony interaction.
- Train both native and non-native speakers of English to enunciate numbers. Underscore the importance of adhering to ICAO number pronunciation and speaking standards, e.g., say every number individually.

Pilots

- Incorporate in flight planning and preparation familiarisation techniques with accents that pilots are most likely to encounter during their planned flight.
- Include in pilot checklists that pilots must verify that ATC has been contacted at every point where communication is required.

Native English-speaking pilots

- Native English speakers should think of English in the flight deck or over the radio as not English as they know it, but instead as a different 'language'.
- On-going language awareness training should be implemented.
- Language awareness training should emphasise the elimination of local slang and non-standard phraseology.
- Language awareness training should incorporate awareness of non-native English listeners in training.

Controllers

- If necessary, conduct research into the optimal amount of information that controller instructions should contain. This research should incorporate non-native English-speaking proficiency issues, including problems with numbers and familiarisation with speaker prosody, including accent.

Non-UK pilots

- Investigate the extent to which readback errors by non-UK pilots operating in UK airspace contributes to miscommunication and aviation incidents. Appropriate steps should be taken to address and correct readback errors by non-UK pilots operating in UK airspace.

Non-UK controllers

- Conduct research specifically into the language proficiency of non-UK controllers. This research should focus on countries in which an accident or serious incident would pose the greatest risk to the UK travelling public, e.g., countries most frequently visited by the UK travelling public.

European issues

- Work with European national aviation authorities to further investigate language-related miscommunication between UK pilots and controllers in countries with significant UK-based traffic.
- Work with European aviation authorities to increase awareness of the dangers of multilingual radiotelephony. Ideally, an agreement between

countries would be made that English is the sole language of aviation on the radio.

- Continue working with the Eurocontrol Call Sign Similarity Service to reduce the number of similar call signs on the same frequency or operating on the same or similar routes.

ICAO issues

- Work with ICAO Member States to assess whether the adoption of English as the sole language in commercial aviation, both in radiotelephony transmissions and at the ground level in airports, represents the best approach to optimal situational awareness, radiotelephony communication, and aviation safety.
- Work with ICAO to expand standard phraseology to include such non-routine events as laser attacks and medical emergencies.
- Collaborate with national aviation authorities to understand further the challenges of ICAO language proficiency, and work to formulate common approaches to address these challenges and improve aviation safety.

Other issues

- If necessary, pursue research into an ‘ideal’ rate of speech for UK controllers speaking with pilots with ICAO Level 4 proficiency.
- Incorporate cultural factors in future research on language-related miscommunication between pilots and controllers. This could involve ethnography, questions in surveys or interviews, or some other means.
- Incorporate awareness of politeness markers into future research on miscommunication between pilots and controllers.

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