

Aviation English Research Project:

Data analysis findings and best practice recommendations

An independent research report commissioned by CAA

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

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.