Standard Phraseology

To facilitate effective and efficient communication, pilots and air traffic controllers are required to use **standard phraseology**, also called standardized phraseology, RT phraseology or airspeak. There is an outline of ICAO standard phraseology in Document 9835 (Chapter 3), and detailed descriptions of the requirements are given in the following publications:

- Volume II of Annex 10 (ICAO, 2007a);
- Chapter 12 of Document 4444 (ICAO, 2007b);
- Document 9432 (ICAO, 2007c).

The last of these publications, Document 9432, is the ICAO "Manual of Radiotelephony". It is available in English, French, Spanish and Russian versions. However, the main emphasis of the ICAO language proficiency programme is on using English, so the following paragraphs focus on English standard phraseology.

Features of Standard Phraseology

Standard phraseology may be differentiated from general language by a number of distinct features. Some examples of these features are in Table 1 at the end of this section. The main points of difference are:

- Pronunciation protocols – prescribed ways in which numbers and letters should be spoken;
- Limited lexicon – the vocabulary consists of less than a thousand words, each of which is assigned a single, precise meaning;[1]
- Modified syntax – compared with general language, many grammatical words are deleted and frequent use is made of nominalizations, imperatives and the passive voice;
- Standardized message structures – the elements of a message (identifying the sender, addressee and message content) should be spoken in a particular order;
- Specific exchange patterns – exchanges of messages typically follow specific patterns (eg: three turns initiated by ATC), with repetition conventions such as *read-back*, whereby a pilot repeats a message to confirm correct reception.

In an oft-cited study of standard phraseology, Philps (1991) documented differences from natural English on all of the main linguistic levels: phonology, lexis, semantics, discourse and syntax. Using a transformational-generative framework to analyse the syntax, Philps listed sentence-level and phrase-level transformations. His analysis highlighted "a pronounced tendency towards ellipsis" in standard phraseology (Philps, 1991, p. 123). To give one simple phrase-level example, the preposition of direction is deleted from the natural language phrase "climb **to** [flight level]" to produce the phrase "climb **Ø** [flight level]". This modification has two effects. Firstly it makes the phrase shorter so it can be spoken more quickly. Secondly, it

[1] According to Document 9835, the vocabulary of standard phraseology is "around 400 words" (ICAO, 2010, p. 3-4). Lopez, Condamines, Josselin-Leray, O'Donoghue and Salmon (2013) reported that it was "less than 1000 different words".

removes the potentially dangerous possibility of listener confusion between two homonyms: the preposition "to" and the number "two".[2]

Estival et al. (2016) provided a comprehensive linguistic description of the aviation English used by pilots and ATC, including discussions of grammatical and lexical word categories that feature in standard phraseology. In terms of grammatical words, some pronouns and determiners are used, but the most prominent category is that of prepositions, as in these examples: "cleared **from** [location] **to** [location]" and "commence approach **at** [time]". The content words include a limited number of adjectives and adverbs, with many more verbs and nouns. One of the few adjectives is "clear(ed)", which, as pointed out by Estival et al., is used with two distinct meanings: "sky **clear**" (ie: weather information) and "**cleared** to land" (ie: authorization). The lexis includes special categories for proper names, call signs, time expressions, units of measurement, and the clock code (eg: "traffic 11 o'clock" to indicate the direction of other aircraft). Estival et al. (2016, p. 45) also noted that phraseology is regularly updated to improve safety: "When a possibility for confusion has been recognized, ICAO and other bodies may recommend changes which then become part of the regulations".

Standard phraseology has been categorized in a variety of ways. Varantola (1989) labelled it a "semi-artificial code", while Breul (2013) used the term "semi-artificial sublanguage". The use of the word "artificial" by these researchers was presumably intended to contrast a code developed for a special purpose (ie: standard phraseology) with natural language (eg: English). However, the distinction between artificial and natural is problematic when applied to languages (or sublanguages or codes) that have all been developed, in one way or another, by humans. Since standard phraseology was intentionally devised for the purpose of human communication, it may alternatively be thought of as a constructed language or a posteriori language.

As noted above, standard phraseology has a grammar and lexis patterned on a simplification of existing language. In Document 9835 it is referred to as a "restricted sublanguage" and defined as "the formulaic code made up of specific words that in the context of aviation operations have a precise and singular operational significance" (ICAO, 2010, p. 6-6). Ragan (2007), coming into aviation from a background in ESL teaching, described standard phraseology as both a "restricted register" and a "singularly context bound special language".

Others have simply labelled standard phraseology as a "restricted code" (Hall, 1976; Varantola, 1989; Estival et al., 2016). The concepts of restricted code and elaborated code were developed by Bernstein (1964) to account for differences in the speech systems of children from different social backgrounds. Characteristics of restricted codes applicable to standard phraseology include: rapid and fluent speech; interlocutors' shared knowledge and expectations; and a low level of vocabulary and syntactic selection. The latter is important because it facilitates prediction, allowing high levels of listening comprehension even under conditions of time pressure. As McMillan (1998, p. 17) noted in a study of ATC

[2] Confusion between homonyms was a causal factor in the 1989 crash of Flying Tiger Flight 66 at Kuala Lumpur. The controller said, "Tiger 66, descend **two** four zero zero [ie: 2,400 feet]", which the captain read back as, "Okay, four zero zero". The captain apparently interpreted the instruction as "descend **to** four zero zero [ie: 400 feet]" (Cushing, 1994; McMillan, 1998; NTSB, 1989).

miscommunications: “Listeners are able to discriminate more effectively among a small number of possibilities than among a large number.”

Table 1: Differences between standard phraseology and natural language.

FEATURE	STANDARD PHRASEOLOGY EXAMPLE	NATURAL LANGUAGE EQUIVALENT[3]
Pronunciation of numbers	“3” is pronounced **|tri:|**	“3” is pronounced **|θri:|**
Pronunciation of alphabet	“G” is pronounced **|gɒlf|**	“G” is pronounced **|ʤi:|**
Limited lexicon	Less than 1,000 words, one of which is “**climb**” with no synonyms	More than 100,000 words,[4] with many synonyms such as “climb”, “ascend”, “rise”, “gain altitude”, “move up”, “soar”
Univocal vocabulary	“**level**” (as in “report your level”) is a generic term for the altitude or flight level of an aircraft in flight	“level” can be a noun, adjective or verb; as a noun, it can mean a horizontal plane, a position on a scale, a measuring instrument, or a flat tract of land
Deletion of subject pronouns	“**Ø** cleared for takeoff”	“**you** are cleared for takeoff”
Deletion of auxiliary verbs	“**Ø** cleared for takeoff”	“you **are** cleared for takeoff”
Deletion of prepositions	“climb **Ø** flight level 280”	“climb **to** flight level 280”
Deletion of determiners	“request **Ø** departure information”	“I’d like to request **the** departure information”
Passive voice	“**cleared** to land”	“I give you permission to land”
Imperative forms	“**climb** flight level 280”	“I’d like you to climb to flight level 280”
Nominalizations	“**airspeed loss** 20 knots”	“we have lost 20 knots of airspeed”

The Purpose of Standard Phraseology

According to Document 9835, standard phraseology has a twofold purpose: “to reduce the possibility for ambiguity and to facilitate efficiency” (ICAO, 2010, p. 5-5). With the implicit

[3] The listing is intended to be illustrative, not exhaustive. For some examples many equivalent natural language expressions are possible.

[4] Crystal, D. (2003, p. 123) pointed out the difficulty of estimating the size of the English language and the lexicon of individual speakers. He noted that a medium-sized dictionary has about 100,000 entries.

assumption that efficiency requires short communications, this twofold purpose is expressed in different ways in ICAO documents, which variously call for "clear, concise, unambiguous language", "clarity, conciseness and correctness" and "maximum clarity, brevity, and unambiguity" (ICAO, 2010, pp. 1-1 & 5-5; ICAO, 2007c, p. 3-2). The words *clear* and *clarity* are not defined in the documents, and it is therefore not evident whether they refer to language coherence, intelligibility, pronunciation, or a combination of these. For some researchers, clarity seems to take on the meaning of a lack of ambiguity. For example, Varantola (1989) and McMillan (1998) simply described the purpose of phraseology as "brevity and clarity". Similarly, the Radiotelephony Manual published by the UK's Civil Aviation Authority noted the need for "clear, concise, standardised phraseology" (CAA, 2015).[5]

There is, however, a conflict between the need for concise communications and the requirement to minimize **ambiguity** because, generally speaking, ambiguity is minimized by the use of elaborate communications. In a pioneering work on aviation human factors, Hawkins (1993, p. 169) noted this problem: "In other fields, such as law and government, messages are lengthened to ensure they are unambiguous. In aviation, phrases are being shortened, due to time pressures, but they still need to be unambiguous."

Hall (1976, p. 133) observed that the tension in pilot-ATC radiotelephony between the simultaneous needs for "great parsimony" and "low ambiguity" was resolved by using a restricted code in which "everything is condensed: grammar, vocabulary, intonation". From this perspective, standard phraseology is a form of high-context communication that is fast and efficient because pre-programmed information is in the receiver and setting, with minimal information in transmitted messages (Hall, 1976). For such a system to work effectively, pilots and controllers require extensive training, and they must necessarily all learn the same set of information. An idea of the degree to which language is condensed in this restricted code may be gleaned from the amount of information contained in training materials: the ICAO Manual of Radiotelephony (Document 9432) contains 102 pages and the UK's CAA Radiotelephony Manual (CAP 413) runs to 358 pages.

Problems with Standard Phraseology

One problem associated with phraseology is that the standard varies from country to country. In the UK, 6 pages of significant differences from ICAO phraseology are listed in the Radiotelephony Manual (CAA, 2015). The differences reflect characteristics of the UK national airspace, such as large numbers of trainee pilots flying solo, as well as items of phraseology that the national authority thinks might lead to misunderstandings. As a consequence, pilots who fly between the UK and other countries must switch between different phraseologies.

A further complication is that there may be different standards *within* a country. For the UK, the Radiotelephony Manual lists 6 pages of significant differences between civil and military phraseology (CAA, 2015). These inconsistencies can cause problems when civilian planes land at military aerodromes. Differences in phraseology were identified as one of the causal factors that led to the 1996 crash of a Spanish Learjet at Royal Air Force Station Northolt in the UK (AAIB, 1997).

[5] This need is not new. One of the recommendations in the report for the 1977 Tenerife runway accident was: "Use of standard, concise and unequivocal aeronautical language" (CIAIAC, 1978, p. 60).

Another problem occurs when pilots and controllers do not adhere to standard phraseology. As stated in Annex 10, "ICAO standardized phraseology shall be used in all situations for which it has been specified" (ICAO, 2007a, p. 5-1). However, one study highlighted by ICAO found that "70 per cent of all speech acts uttered by native and non-native speakers, and for which a phraseology is prescribed, are not compliant with the recognized standards" (Mell, 1992, as cited in ICAO, 2010, p. 1-1). Document 9835 suggests that non-compliance may be due to various factors, including "respectable reasons such as pressure of work, and less respectable reasons such as carelessness and insensitivity" (ICAO, 2010, p. 3-5). It continues with an illustration of the risks of not using phraseology accurately, in this case the protocol for numbers:

> One example of such failure would be to identify a runway by saying 'Runway ten left' instead of 'Runway one zero left'. The word 'ten' could very easily be heard as 'turn', with obvious risks for the safety of ground movements. (ICAO, 2010, p. 3-5)

Instances of non-adherence to standard phraseology have been widely recorded in the research literature. In a review of 43 papers addressing pilot-ATC radiotelephony, Prinzo and Britton (1993) found that pilots and controllers used qualitatively different communication techniques, and they noted a tendency for pilots to use non-standard phraseology. Cushing (1994) suggested that a contributory factor to the 1981 accident at John Wayne Orange County Airport, California, was pilots switching from standard phraseology to **plain language**. Orasanu, Fischer and Davison (1997, p. 9) cited examples of American controllers using "local jargon, colloquialisms, or non-standard phraseology" such as the idiomatic expression, "keep your eyes peeled". Using the ASRS database, Cardosi, Falzarano and Han (1998) analysed 386 reports of pilot-ATC miscommunication, which they classified into three types of exchange pattern errors.[6] Prinzo, Hendrix and Hendrix (2006) investigated pilot-ATC communication errors using 50 hours of ATC recordings from American airports, and – noting that pilots and controllers have been encouraged to send shorter and less complex messages – identified a tendency for some pilots to use non-standard contractions for altitude and speed. Howard (2008) analysed over 15 hours of pilot-ATC dialogue recorded at US airports and found that deviations from ATC protocol increased the likelihood of problematic communication.

Concern about non-adherence to ICAO standard phraseology was also reported in a worldwide survey conducted by the International Air Transport Association (IATA) in collaboration with the International Federation of Air Line Pilots' Associations (IFALPA) and the International Federation of Air Traffic Controllers' Associations (IFATCA). Analysis of responses from 2,070 pilots and 568 controllers indicated that "non standard phraseology" and "use of general aviation English in lieu of standard phraseology" were two operational factors that increased the likelihood of communication errors. The study concluded that the use of non-standard phraseology was "a major obstacle" to effective communications between ATC and pilots (IATA, 2011, p. 53).

[6] Identifying and classifying errors in pilot-ATC communications is not straightforward. Citing a study by Hollnagel and Amalberti (2001) which used data from the Human Error in Air Traffic Management (HERA) project, Dekker (2005) noted significant differences in the errors identified by trained observers when evaluating the same ATC session with the same taxonomy.

Anecdotal evidence gathered during the implementation of ICAO's language proficiency programme indicated significant variations in the use of standard phraseology by region. At an ICAO regional workshop in Bangkok, controllers from Indonesia and Brunei said that 80-90% of their communication was standard phraseology versus 10-20% plain English. These numbers were echoed by the Director of the Air Traffic Services Department of the Japanese Civil Aviation Bureau. By contrast, a tower supervisor at Juan Santamaria International Airport in Costa Rica stated during a plenary session at the 2007 ICAEA Forum that over 50% of pilot-ATC communication in the Central American region was in plain English. The difference in the figures may be partly due to wishful thinking. The Asian controllers were keen to show adherence to ICAO phraseology whereas the Costa Rican controller wanted to stress the importance of plain English. Nevertheless, the figures are suggestive of significant regional differences in language use and may reflect differences in practice resulting from different national culture characteristics.

In addition to the problems outlined above, standard phraseology is characterized by one fundamental limitation: as a consequence of the limited vocabulary and syntax, it is not sufficient to cover all possible situations that arise during flight operations. It has been designed to deal with most normal operations and some non-normal ones (eg: emergency descents). However, if an unexpected event happens for which there is no phraseology, pilots and controllers must resort to plain language.

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