A Review of Radiotelephony Communication Phraseology Standards and Implications

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Abstract: The use of non-standard radiotelephony communication phraseology is a major barrier to effective communication between pilots and air traffic controllers, and is one of the contributing factors of air-ground miscommunications. Therefore, the International Civil Aviation Organization (ICAO) and many national civil aviation authorities have established radiotelephony communication phraseology standards to improve the safety of aviation communication. However, with the development of civil aviation, some problems were revealed in the application of the standard radiotelephony communication phraseology in flight operation. This paper compares and analyses the domestic and international standards of radiotelephony communication phraseology, and provides implications on how to optimize the radiotelephony communication phraseology standards to enhance the efficiency of air-ground communication by taking into account the changes in the radiotelephony communications.

1. Introduction

With the development of aviation operations, there's an increase of unsafe incidents and accidents in flight, for which radiotelephony communication errors are one of the contributing causes. According to The International Air Transport Association (IATA) "Pilot/Air Traffic Controller Phraseology Study", the major causes of radiotelephony communication errors include: non-standard phraseology, rate of speech, usage of slang, ambiguity in general aviation English, lack of coordination, pronunciation difficulties, influence of accents, and cross-cultural communication, etc.

According to the conclusion of this report, the improper use of radiotelephony communication phraseology is a major barrier to effective communication between pilots and air traffic controllers, because the use of non-standard phraseology or the omission of key information can distort the meaning of the intended message, leading to miscommunication and potential traffic conflicts. Standard phraseology can reduce discourse ambiguity, eliminate barriers to understanding caused by different languages, accents or dialects, and promote mutual understanding, thereby enhancing communication efficiency and reducing communication errors [1-2]. Therefore, ICAO has developed phraseology standards for radio communication (ICAO Annex 10, Annex 11; ICAO Doc.

4444, Doc. 9432). The civil aviation authorities of many countries, such as the UK, the US and China, have also developed national standards for radiotelephony communication phraseology, by modifying the ICAO standards to suit local operations [3-4]. This paper compares and analyses domestic and international radiotelephony communication phraseology standards, and provides suggestions on how to improve the radiotelephony communication phraseology standards by taking into account recent changes in flight operations.

2. Domestic and International Standards of Radiotelephony Communication Phraseology

Many civil aviation organizations and agencies have established standards for radiotelephony communication phraseology, which are published in related documents and manuals. The standards for radiotelephony communication phraseology developed by ICAO are reflected in the following documents.

(1) Chapter V of Volume II of Annex 10 - Aeronautical Telecommunications describes the basic concepts, essential requirements and key terms for radiotelephony communications.

(2) Chapter VI of Annex 11 - Air Traffic Services of the Convention describes the basic requirements for air traffic service communications.

(3) Manual of Radiotelephony Doc9432-AN/ 925 describes the phraseology for radiotelephony communication in different phases of flight under routine and non-routine situations.

(4) Rules of the Air and Air Traffic Services Doc 4444-RAC/501 describes the main phraseology used in different conditions and situations, in accordance with the requirements of air traffic control.

These documents constitute the main ICAO regulations on radiotelephony communication phraseology and are the basis and guidance for national standards of radiotelephony communication. Many civil aviation organizations and agencies have developed national standards for communication terminology based on ICAO standards, including the following documents:

(1) The North Atlantic Treaty Organization (NATO) has developed a standard for radio communications for air traffic control in NATO Standing Agreements (STANAG) 3817 Standard R/T Phraseology which are implemented in its member countries.

(2) The FAA specifies radio communications phraseology as well as communication techniques in Chapter 4, Section 2 of the Navigation Information Manual and elaborates on radio communications phraseology in the Pilot's Handbook of Aeronautical Knowledge and the Manual of Instrument Procedures.

(3) The UK Civil Aviation Authority has produced a Radio Communications Manual (CAP413) which formulates the standard phraseology for radio communications used in operations within UK airspace.

(4) EUROCONTROL has also developed a Guide of Radiotelephony Phraseology for General Aviation Pilots in Europe (GAP).

(5) In accordance with ICAO regulations, Civil Aviation Administration of China has formulated the national standard of "Air Traffic Communication Phraseology" (MH/T 4014-2003) for use by air traffic controllers and pilots.

Each of these regulations or standards expands the ICAO Radio Communication Standards and are continually revised as operation changes.

3. Changes in Radiotelephony Communication

3.1. Changes in Radiotelephony Communication Phraseology in Operation

In recent years, many changes have occurred in radio communications phraseology in operation. With the application of new ATC technologies, such as CPDLC, PBN operations, ADS-B, HUD

operations, COO/CDO operations, TBO operations, etc., new communication phraseology emerge in operations.

Changes in ATC positions (e.g. the addition of new control positions) lead to the emergence of new communication phraseology, such as ramp control and traffic management phraseology.

The emergence of new traffic situations (e.g. the interference of drones, etc.) give rise to an increasing number of new communication phraseology in operation.

With the occurrence of new categories of unsafe accidents and incidents, the scope of emergency communication phraseology is expanded.

3.2. Changes in Domestic and International Phraseology Standards

Recent changes in radiotelephony communication phraseology are partly reflected in the newly revised ICAO manuals and documents. ICAO has revised radiotelephony communication phraseology in relevant annexes. ADSB, 8.33 kHz channel spacing, RVSM and GNSS, airport related communication phraseology are added in the 14th edition of Doc.4444 (ICAO Doc.4444); ACARS related communication phraseology are added in the 15th edition; ground and airborne de-icing/anti-icing procedure communication phraseology are added in Chapter 12 of the 16th edition. PBN and VOR/ GNSS lateral spacing related phraseology are added in Annex 6. The transmission of numbers has been revised in the 7th edition of ICAO Annex 10.

Changes in phraseology are also reflected in the development and revisions of civil aviation documents of phraseology standards in China. CAAC document IB-FS-2008-002 of 2008 (Application of Automatic Dependent Surveillance-Broadcast [ADS-B] in Flight Operations), and document AC-93-TM-2011-01 of 2011 (Regulation on Control Operations of Automatic Dependent Surveillance-Broadcast [ADS-B]) describes the phraseology for ADS-B communications; CAAC Document IB-TM-2014-002 of 2014 (Civil Aviation Air Traffic Flow Management Operational Guidance Material) describes the principles of air traffic flow management communication, the structure and types of flow management communication, and provides specific examples of flow management communication; CAAC Document AP-121-FS-2008-02 of 2008 (Airline HF The 2008 CAAC document AP-121-FS-2008-02 (Operating Procedures for Airline HF Voice Communications) defines the communication procedures and communication phraseology for HF voice communications.

In addition, relevant civil aviation units in many countries have also designed some communication manuals and formulated relevant documents to regulate the communication phraseology in response to the changes in real operating conditions, such as the "International Route Communication Guidance" by Air China, which introduces the characteristics of communication phraseology of major international routes; the No. 2 document of 2019 of the Central South Air Traffic Control Bureau (Notice on the Unification of Certain Air Ground Communication Phraseology in the Tower Control) unifies and standardizes tower control phraseology; Civil Aviation Data Communication Company and Airbus jointly developed a TBO operation phraseology manual.

4. Changes in Radiotelephony Communication

CAAC developed a standard for radiotelephony communication phraseology in 2003 which was implemented in 2004. The standard has played a significant role in the safety of air transportation in China. However, with the development of air traffic operation, some problems in the current communication standard are exposed. According to some research on the use of radiotelephony communication phraseology by pilots and controllers, the main problems with the radiotelephony communication phraseology standards are as follows.

4.1. Lack of New Phraseology

The original radiotelephony communication phraseology failed to satisfy the communication needs in new situations in actual operation. The use of new ATC technology, new ATC positions, and the emergence of new traffic conditions leads to many changes in radiotelephony communication phraseology in real operation, such as the new communication phraseology of CPDLC, PBN operation, ADS-B, HUD operation, COO/CDO operation and TBO operation, the new communication phraseology of ramp control and traffic management, and the communication phraseology for new air traffic situations. These new communication phraseologies have already appeared in the radio communication phraseology related documents and manuals of ICAO, some national civil aviation bureaus and relevant civil aviation agencies, and CAAC should incorporate the new phraseology in operation in air-ground communication phraseology standards.

4.2. Lack of Communication Phraseology Standards in Non-Routine Situations

The original communication phraseology standard can only be applied to communication in routine situations, and there is no corresponding standard for abnormal and emergency situations. When air traffic controllers encounter these unpredictable and special situations, they rely mainly on daily English expressions, which are often not concise, clear and effective. Due to the lack of communication phraseology standards in various emergency situations, some communication errors occur, which lead to many unsafe events. Therefore, phraseology used in non-routine situations should be defined and standardized so that air traffic controllers can express themselves more effectively when encountering such situations in actual operations to ensure operation safety.

4.3. Disconnection of Phraseology Standards from Actual Operations

Further adjustments should be made to the general phraseology, airport control phraseology, approach control phraseology, area control phraseology and radar control phraseology in the phraseology manual. The section of phraseology and acronyms lacks many new terms that appear in real operation; the section of aerodrome control phraseology lacks the terms for heliport operation communication and airport vehicle communication; the section of radar phraseology lacks TCAS communication terms; the section of approach control phraseology lacks GNSS terms and PAR approach communication terms. There is also a lack of phraseology for special situations and emergencies (e.g. wake turbulence, wind shear, fuel warning, etc.). Furthermore, some of the original phraseology are obsolete, and are no longer applicable to actual operations, such as 8.33 kHz phraseology. This part of the phraseology should be revised to suit the new situations.

4.4. Lack of Convenience and Friendliness

The original manual of radiotelephony phraseology is not user-friendly. Firstly, in the fourth section of the phraseology manual, there is a lack of specific descriptions of scenarios and specific examples for the use of standard phraseology. With the absence of context, air traffic controllers may lack situational awareness, leading to incorrect use of phraseology in flight operations [5-6]. Secondly, the original phraseology manual is presented in traditional text form, and the phraseology cannot be searched quickly and efficiently. Therefore, the form of the manual should be upgraded to make the use of the new standard more convenient.

5. Recommendations and Implications

Due to the emergence of various new situations in actual operation, many changes in the radiotelephony communication phraseology occurred (as shown in Figure 1). Therefore, new phraseology standards for air ground communication should be designed to adapt to new situations, circumstances and changes. New phraseology that emerge in actual operation should be incorporated into the standard phraseology; phraseology that have become obsolete and are no longer used in actual communication should be deleted from the manual of standard phraseology [7-10]; and the phraseology for air-ground communication in various emergency situations should be further standardized. Specific changes in phraseology should be made in the following areas (as shown in figure 2).

Figure 1: Changes in radiotelephony communication.
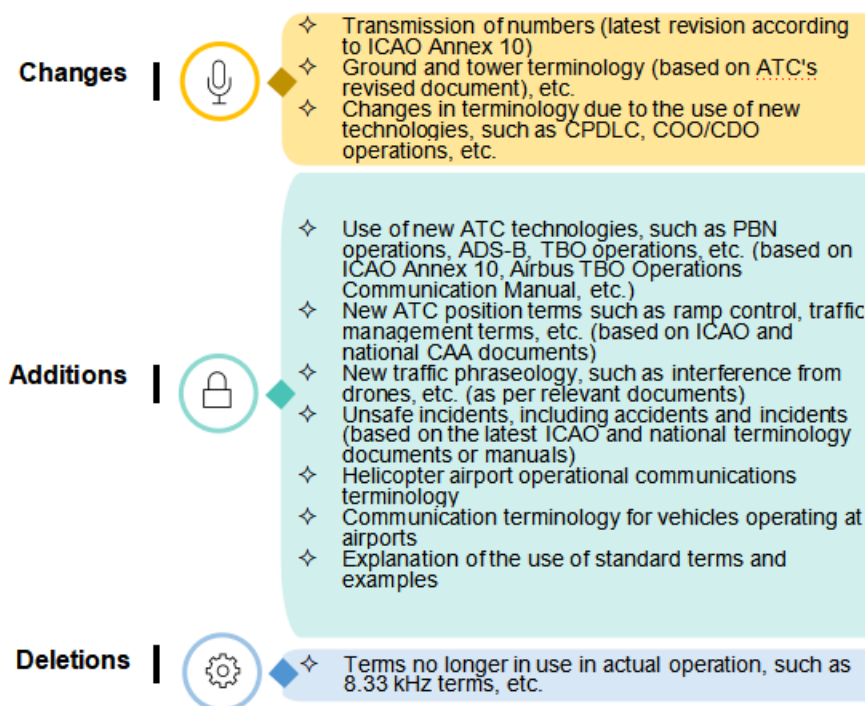
6. Conclusion

Figure 2: Changes in phraseology standards.

The use of non-standard radiotelephony communication phraseology is a major barrier to effective communication between pilots and air traffic controllers, and is one of the contributing factors of air-ground miscommunications. Because of the changes in the radiotelephony communication phraseology, new phraseology standards for air ground communication should be designed. The new standards for air ground communication phraseology should reflect the changes in actual operations, adapt to the new needs of actual operations, and fully absorb the new communication radiotelephony phraseology in actual operations. In compliance with the latest ICAO phraseology standards, the actual operation of Chinese civil aviation should be taken into account to form a new radiotelephony communication standard which are suitable to the air traffic operations in China.

References

[1] Guan Bo, (2003) on the improvement of ATC regulations from the perspective of land-air calls. China Civil Aviation, 8, 64-67.

[2] Huang Dexian. (2004) Characteristics and translation of English for civil aviation land and air calls. China Science and Technology Translation, 4, 14-16+46.

[3] Huang DY et al. The Civil Aviation International Airline Flight English Practical Talk. Beijing: China Civil Aviation Publishing, 2015.

[4] Huang DY, Wu Tuxing. (2005) Analysis of Flight Accidents Caused by Civil Aviation English Communication Failures. Journal of Civil Aviation Flight Academy of China, 1, 46-49.

[5] Pan Weijun, Wu Quan, Chen Huaqun, Luo Xiaoli. (2008) Analysis of Air Traffic Radio Land-Air Call Errors. Western China Science and Technology, 155(30):1-3.

[6] Peng L. (2009) an analysis of discourse misunderstanding in land-air calls from correlation theory department. Journal of Civil Aviation Flight Academy of China, 1, 13-15

[7] Xiao Ling. An English Introduction to Global Flight Accident Case Studies. Beijing: Foreign Language Teaching and Research Press, 2010.

[8] Xu Jiujiu. (1995) Twenty years of discourse analysis. Foreign Language Teaching and Research, 1, 14-20+80.

[9] Xu Jiujiu. (1997) Discourse Analysis in China. Foreign Language Teaching and Research, 4, 21-25+81.

[10] Zhu Yongsheng. (2003) Fifty Years of Discourse Analysis: Review and Prospects. Foreign Languages, 3, 43-50.