

Analysis of the Aircraft Call-Sign Similarities in FIR Prague

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Abstract:- This article shows the analysis of call-sign similarity and confusion issues in the Czech airspace (which means the use of similar call-signs by aircraft operating in the same area on the same radiotelephony frequency often gives rise to potential and actual flight safety incidents – this hazard is usually referred to as “call-sign confusion”). Based on Eurocontrol’s general similarity rules was created algorithm identifying call-sign similarity from raw radar Asterix data in FIR Prague. The results (number of occurrences) are discussed in the text. Some recommendation for preventing and avoiding call-sign similarity and confusion are mentioned in the end of this text.

Keywords:- call-sign confusion, call-sign similarity, general similarity rules, prevention against call-sign similarities

I. INTRODUCTION

In line with ongoing air traffic growth, there are increasingly frequent the situations where aircraft with similar identification or call-sign appear in the same controlled airspace. Many actual flight safety incidents were caused by reason called call-sign confusion, which means the aircraft operating in the same area, on the same radio frequency. It can lead to the situations when aircraft taking a clearance not intended for them. The danger of an aircraft taking and acting on a clearance intended for another is obvious.

Before an examination of the call-sign confusion problem the rules governing the use of aircraft call-signs will be reviewed. These rules are laid down in ICAO Annex 10 [3]. The relevant paragraphs are summarized below.

Three different types of aircraft call-sign may be encountered, as follows:

- (a) The characters corresponding to the registration marking of the aircraft (e.g. OKELA). The name of the aircraft manufacturer or model may be used as a prefix (e.g. Cessna OKELA);
- (b) The radiotelephony designator of the aircraft operating agency, followed by the last four characters of the registration marking of the aircraft (e.g. Lufthansa BCDE) – very rarely used;
- (c) The radiotelephony designator of the aircraft operating agency, followed by the flight identification (e.g. Lufthansa1234).

An aircraft (pilot-in-command) is not permitted to change its call-sign during the flight, except temporarily on the instruction of an air traffic control unit in the interests of safety.

In order to avoid any possible confusion, when issuing ATC clearances and reading back such clearances, controllers and pilots must always add the call-sign of the aircraft to which the clearance applies.

Call-sign confusion can lead to dangerous safety incidents such as: loss of separation, runway incursion, level busts or controlled flight into terrain (CFIT). There are many factors which contribute to call-sign confusion, associated with:

- (a) the way the message is transmitted,
- (b) the quality of the communication channel,
- (c) the perception and cognitive processing of the message, influenced between the other things by the frequency workload and flight phase complexity.

Call-sign confusion can arise because of visual or phonetic confusion associated with the sequencing of letter and number groups in a call-sign.

II. CURRENT SITUATION IN EUROPE

Analysis of ATC reported events show that around 7% involve incidences where call-sign similarities take place. This was identified in the European action plan for air ground communication safety as a significant contributor to air-ground communication issues. There for there was established by the Network Manager Operations Centre NMOC project called “Call-sign Similarity (CSS) project” with the aim to reduce the level

of operational call-sign confusion events and therefore improve level of safety (in 2008). It is calculated that it will eliminate over 80% of the call-sign similarities incidences and thus improve safety.

Further studies have indicated that the best defence against call-sign confusion consists of eliminating, or reducing the chance of having two (or more) aircraft with similar call-signs on the same radio frequency at the same time.

There are defined three service levels of operations. First two levels (service level 0 and 1) were already implemented in March 2012. During the definition and implementation of the first phase (level 0) were defined general similarity rules (see section III.) to be applied in the process of detection and potential call-sign conflict resolution.

III. GENERAL SIMILARITY RULES

These rules created by EUROCONTROL are applicable to flights within a single aircraft operator schedule, i.e. aircraft operator ICAO designator remains the same). These rules are recommended by the Call-Sign Similarity User Group (CSS UG). This group consists of the air navigation service providers, airspace users and airport operators [1], [4].

The order of the following subsections in the text below is significant with the most critical rules at the beginning.

A. Call-sign Format

Call-signs need to comply with the allowed formats defined by ICAO in Doc.4444 Field 7 (a), Aircraft Identification). Normal format consists of 3 letter ICAO aircraft operator designator followed by 1 to 4 alphanumeric characters (usually called as Flight ID). There are identified two subgroups of rules:

- (a) **Identical final digits** - check for 2 identical final digits in the Flight IDs (example: ABC234 vs. ABC534).
- (b) **Identical bigrams** - check for blocks of contiguous characters which form a bigram (example: ABC34JT vs. ABC527JT).

B. Letter to Avoid

Some single letters (e.g. “O” vs “0” vs. “Q”, “I” vs “1”) may be easily confused with digits and are therefore best avoided (example: ABC841I, ABC460O, ABC8OQ). This group of rules covers following types:

- (a) **Anagrams** – check for anagrams occurring within the Flight IDs (example: ABC2976 vs ABC2967, etc.).
- (b) **Identical block of digits** – check for call-signs which form blocks of contiguous identical characters which are:

- a. the same length, or
- b. 2 vs 3 characters, or
- c. 3 vs. 4 characters.

(Example: ABC52 vs. ABC652 vs. ABC524 vs. ABC52R).

- (c) **Parallel characters** – check if characters composing the call-signs form parallel alignment of identical characters (example: ABC64 vs. ABC604 vs. ABC6134).
- (d) **Identical digits root** – check for prefix blocks of identical digits (example: ABC97 vs. ABC971 vs. ABC971L).
- (e) **Identical final letter** – check for call-sign with identical final letter (example: ABC64L vs. ABC916L).

C. Triple Repetition

This is very specific form of similarity where 3 digits are repeated within Flight ID and can be in radiotelephony very easily interchanged for flight level or any runway values. Furthermore, with repetition 3 digits is a high risk of dropping one of the digits, which could cause confusion with a different Flight ID.

- (a) **Flight level values** – specific form where Flight ID is equal to the digit used in a flight level communication. This is one of the reason why ICAO Doc 8585 recommends that values 0 and 5 should not be used as the final figure in call-signs. Values like 040, 050, ... 390, 400 ... may cause confusion with flight level values (example: ABC340, ABC095).
- (b) **Any runway values** – situation where Flight ID is equal to the runway identifiers. Combination of numbers ranging from 01 to 36 (eventually followed by the letters L (left), R (right) or C (center)) should be avoided as well. It is highly recommended to avoid the value of actual runway designators at departure and destination aerodromes (example: ABC36L, ABC24, ABC18C).

IV. ANALYSIS OF CALL-SIGN CONFUSION IN EUROPEAN CONTEXT

Call-sign confusion (CSC) occurred at more than 50 different locations across Europe during last 5 years. The largest number of CSC events (67%) occurred during the en-route phase while only 22% were recorded during the approach phase. The remaining events were during take-off, taxiing and standing. It is worth stating that, in 72% of airline reported cases, the confusion occurred between 2 or more aircraft from the same company; the remaining 28% involved aircraft from different companies. The majority of CSC are between two aircraft (97%) while between three and more aircraft are 3%. CSC was the cause of 5,5 % of the level busts and runway incursions (Note: many of incidents, where CSC is identified as the main issue, could be found in the public database of incidents and news in aviation called Aviation Herald

V. ANALYSIS OF CALL-SIGN CONFUSION IN THE CZECH REPUBLIC

Local air navigation service provider in the Czech Republic (ANS CR) evaluates every year the call-sign similarities and confusion within its Safety analysis documents. Among others it is aimed for accuracies of similar call-sign in FIR Prague. For analysis were used raw radar data in ASTERIX format Category 062.

A. Methodology

Within individual ACC (area control centre) operational sectors in FIR Prague. Similar call-signs are searched from radar data by using algorithm containing general rules defined by EUROCONTROL’s working group (see section III).

In the table below you could be find examples of call-sign similarities (CSS) based on defined rules derived from real analysed data.

Table I: Examples of CSS derived from analysed data from the Czech airspace

Name of the rule	Example
Anagram	LOT335 / LOT353
Identical final letter	AUA274L / AUA332L
Identical 2 final digits	AUI402 / AUI902
Identical 3 final digits	BAW139 / UAU139
Identical digit root	DLH2531 / DLH2541
Parallel characters	KLM1357 / KLM1847
Letters to avoid	CSA7WI
Flight level values	CSA200

B. Results

The amounts of similar call-signs in FIR Prague in each month in years 2013 – 2015 grouped by rules described in Table 1 are shown in Figure 1 (2015), Figure 2 (2014) and Figure 3 (2013). By comparing data from longer period it is confirmed that the amount of detected similar call-signs is almost unchanged over the past 5 years.

It is also important to mention that all mandatory reports of similar call-signs are automatically distributed to EUROCONTROL’s office where should be each occurrence individually solved with aircraft operator. Additionally, at the national level it is solved directly between ANS CR and major operators (Czech Airlines, Travel Service, Lufthansa).

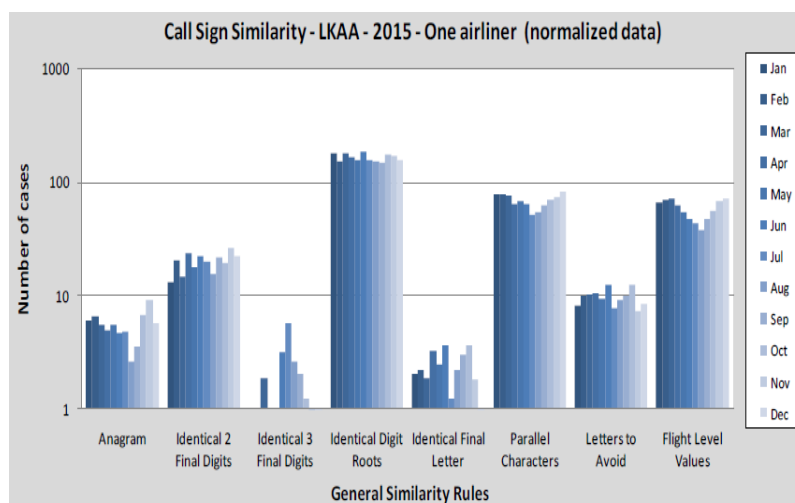


Figure 1 – Amount of call-sign similarities in the Czech airspace in 2015

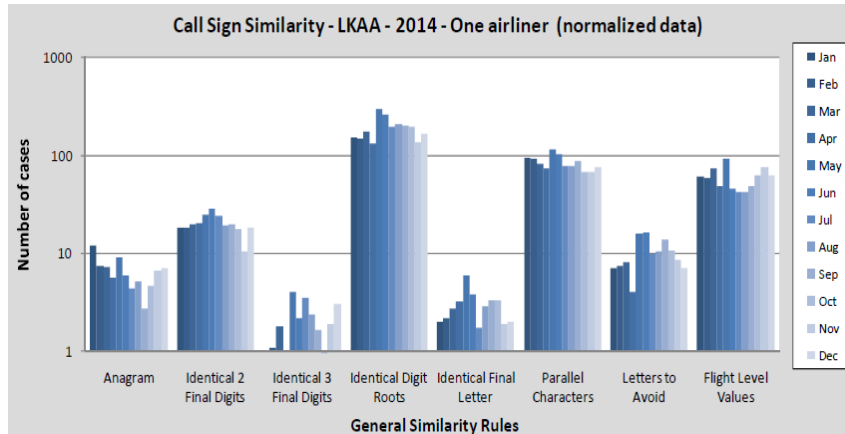


Figure 2 – Amount of call-sign similarities in the Czech airspace in 2014

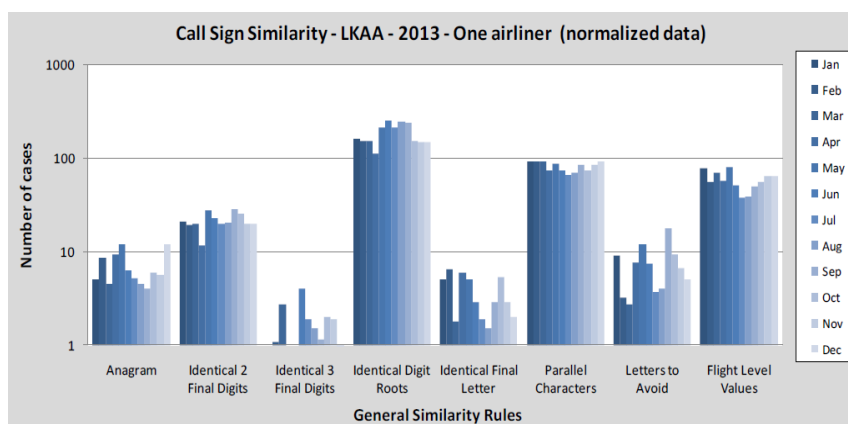


Figure 3 – Amount of call-sign similarities in the Czech airspace in 2013

One of those examples is solved incident report issued by ATS unit APP Prague regarding similar call-sign DLH5RW and LOT5RW. As the result was change of the identification for Lufthansa flight. The new identification used for this flight is DLH4KJ. Another example of similar call-sign was reported by ATS unit TWR Prague where were reported two flights SAS767 (flight from Copenhagen to Prague) and SAS1767 (flight from Stockholm to Prague). Both flights were very often at the same time on TWR frequency (for radar screen see figure 4).



Figure 4 – Radar screen with similar call-signs (flights SAS767 and SAS1767) on final RWY 24 at LKPR

Based on issued air traffic controller's reports and internal ANSP's audit office were completely redesigned set of used call-signs of local operator Travel Service in 2014. This change has brought complete avoidance of quadruple occurrence of similar call-signs of Travel Service at the same time within one operational ACC sector.

VI. CONCLUSION AND RECOMMENDATIONS

Analysis of data from 2014 and 2015 shows that three most common general similarity rules in the Czech airspace are:

- Identical digit rules,
- Parallel characters and
- Flight level values.

Based on known rules (defined in section III.) and based on issued reports to EUROCONTROL was created set of recommendations (see following subsections) for several involved subjects dealing with call-sign similarities such as air traffic controllers, pilots (flight crew) and aircraft operators. – see following subsections [4].

A. Air Traffic Controllers

Air traffic controllers when providing air traffic services shall use correct radiotelephony phraseology and related procedures and discipline at any time. They should be sure that all clearances are read-back correctly. Of course not everyone is native speaker and in such cases should controllers take extra care when language difficulties may exist. Controllers should also warn the pilots of aircraft on the same radiotelephony frequency having similar call-signs that call-sign confusion may occur. According to Annex 10 they should instruct one or both aircraft to use alternative call-signs while they are on the frequency.

In some cases a transmission could be blocked when two or more aircraft are responding to the same clearance. Typically the controller would hear a partial or garbled read-back. If a blocked transmission is suspected, ensure that both aircraft retransmit their messages and confirm carefully that a clearance has not been taken by an aircraft for which it was not intended. Where an actual or potential call-sign confusion incident is observed, controller or supervisor should file a report using the national mandatory incident reporting system or voluntary incident reporting system as appropriate.

B. Aircraft Operators

Also the aircraft operator can do a lot to mitigate the call-sign confusion and similarities. When planning flight schedules, they should avoid using of similar numeric call-signs within the company. Effectively, this means, do not use commercial flight numbers as call-signs. Very beneficial seems to be the coordination with other operators to reduce to a minimum any similar numeric and alphanumeric elements of call-signs. It is also highly recommended not to use repeatedly call-signs involving four digits and, wherever possible, use no more than three digits (e.g. DLH555). Also in case of alphanumeric suffixes are to be used, coordination of letter combinations with other airspace and airport users is required. Operators should also follow simple rule which is not using alphanumeric call-signs corresponding to the last two letters of the destination's ICAO location indicator (e.g. DLH25PR for a flight inbound to Prague). Quite good option is to use some numeric and some alphanumeric call-signs (rather than all numeric or all alphanumeric). It is evident that in some cases are similarly numbered call-signs inevitable; in such cases operators should enable a significant time and/or geographical split between aircraft using similar call-signs. Last but not least, very important is nowadays to implement a call-sign de-confliction programme within the airline, to review and if necessary amend call-signs.

C. Flight Crew (Pilots)

In direct touch with call-sign similarities and potential confusions are pilots. Also they can do a lot for prevention (e.g. always using headsets during times of high radiotelephony loading always wearing a headset when members of the flight crew are involved in other tasks and may not be monitoring the radiotelephony). According to Annex 10, the pilots have to use full radiotelephony call-signs at all times, unless call-sign abbreviation has been asked by air traffic controller.

In case that pilots are in doubt about an ATC instruction, they shouldn't use read-back for confirmation (instead, positively confirm instructions with ATC). This procedure should also be followed if any doubt about a clearance exists between flight crew members. From time to time the instructions issued to the pilot by the controllers can seem strange. In such case the question for explanation of unexpected instructions for any stage of flight is in place to avoid any misunderstanding.

Pilots should actively monitor ATC instructions at critical stages of flight and compliance with them. They should also advise to ATC if any of the following situations is observed:

- two or more aircraft with similar call-signs are on the RTF frequency,
- it is suspected that an aircraft has taken a clearance not intended for it,
- it is suspected that another aircraft has misinterpreted an instruction.

Although, it is not an official procedure according to Annex 10 or Doc 4444, many pilots hearing that two transmissions block each other, call out “blocked”, after which all transmitting parties try once more to pass their messages to announce to the ATC that instruction couldn’t be understood.

As well as the controllers should file a report, also the pilots are kindly requested to file a reports using the national mandatory incident reporting system or voluntary incident reporting system as appropriate after finishing a flight where an actual or potential call-sign confusion incident is observed.

REFERENCES

- [1]. Euroncontrol, Network Manager, EVAIR Safety Bulletin No 12 Summer Seasons 2008 – 2013, September 2013.
- [2]. Eurocontrol, Shelvin Philip, CSST User Guide, edition number: 5.0, 27. 10. 2015.
- [3]. ICAO Annex 10, Volume II.
- [4]. Eurocontrol, European Action Plan for Air Ground Communications Safety, Edition 1.0, May 2006.
- [5]. ŘLP ČR, s.p., Safety Monitoring 2012 – Safety Analysis, version 1.0, 14. 3. 2012, ISQMS/SAF/2013-01.
- [6]. ŘLP ČR, s.p., Safety Monitoring 2013 – Safety Analysis, version 1.0, 21. 2. 2014, ISQMS/SAF/2014-06.
- [7]. ŘLP ČR, s.p., Safety Monitoring 2014 – Safety Analysis, version 1.0, 7. 3. 2015, ISQMS/SAF/2015-15.
- [8]. CAA UK, ACCES – Aircraft Call-sign Confusion Evaluation Safety Study, CAP 704, February 2004, ISBN-0-86039-787-4.
- [9]. Lawrence Richard, Call-sign Similarity Project Overview, presentation from CSCWG, 16.-18.2.2014, Abu Dhabi.