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WORKING PAPER

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COMMITTEE A

Agenda Item 3: Enhancing the global air navigation system
3.5: Other ATM issues

NAVIGATIONAL REFERENCE SYSTEM — THE LIMITATIONS OF THE CURRENT SYSTEM AND POSSIBLE WAY FORWARD

(Presented by Germany)

EXECUTIVE SUMMARY

This paper addresses limitations of the current provisions governing the identification of significant points. It proposes to intensify work on an extension of the "five letter name codes" (5LNC) scheme and promotes studies on a longer-term solution, which encourages transition towards a digital service oriented environment allowing implementing new and enhanced capabilities. The paper calls on ICAO to develop and adopt globally harmonized and interoperable solutions to these challenges.

Action: The Conference is invited to:

a) request ICAO to expedite work on development and adoption of provisions allowing for an extension of the current 5LNC scheme while maintaining backward compatibility necessary to support global interoperability and consistency; and
b) request ICAO to study a longer-term solution addressing limitations of the current navigational reference system.

1. INTRODUCTION

1.1 In 1976, the Ninth Air Navigation Conference agreed to amend ICAO provisions, including Annex 11 – *Air Traffic Services*, on principles governing the establishment and identification of significant points. Such points account for a specified geographical location used for defining an air traffic services (ATS) route or the flight path of an aircraft and for other navigation and ATS needs. A variety of different coding guidelines for the identification of significant points exists. Typical examples are points marked by the identification of a radio navigation aid (e.g. FFM) or a unique five-letter pronounceable "name-code" (e.g. ASKIK). A five alphanumeric code could be chosen for a waypoint used in support of area navigation standard instrument departures (SIDs), standard instrument arrivals (STARs) s and instrument approach procedures. Moreover, industry specifications offer additional coding options.

1.2 Germany, as part of the Single European Sky initiative and following ICAO's guidance as provided in the Global Air Navigation Plan (GANP), is fostering an airspace design based on a performance-based navigational infrastructure. Waypoints, placed where operationally beneficial and decoupled from ground-based navigation aids, improve airspace use, facilitate user-preferred routings, reduce pilot and air traffic control (ATC) workload, and support the resolution of traffic conflicts and weather avoidance.

2. DISCUSSION

2.1 Major changes in airspace design such as the widespread implementation of performance-based navigation (PBN), transitional arrangements towards a free route airspace (FRA), the provision of specific visual flight rules (VFR) reporting points with name-codes had generated significant demand on the already capacity limited current five letter name-code (5LNC) system.

2.2 In the European Region, a dedicated European Air Navigation Planning Group (EANPG) Task Force undertook considerable work on the subject, in particular to explore capacity limitations of the current 5LNC system. The following two tables provide information on newly assigned and released name codes over 10 years, as recorded in ICAO's international codes and routes designators (ICARD) database.

ASSIGNED	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	TOTAL
APAC	1 835	78	13	37	318	768	387	877	803	948	**6 064**
ESAF	0	0	1 170	107	110	73	231	37	51	48	**1 827**
EUR/NAT	811	1 145	1 186	960	1 452	1 349	1 451	1 937	1 928	1 645	**13 864**
MID	139	129	283	485	201	152	361	130	177	286	**2 343**
NACC	0	6 408	8 063	5 320	2 836	1 235	851	966	1 048	139	**26 866**
SAM	0	2 105	43	222	679	248	395	454	752	949	**5 847**
WACAF	0	0	663	47	110	52	80	204	121	59	**1 336**
TOTAL	**2 785**	**9 865**	**11 421**	**7 178**	**5 706**	**3 877**	**3 756**	**4 605**	**4 880**	**4 074**	**58 147**

Table 1 – number of new assigned 5LNC

RELEASED	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	TOTAL
APAC	1	0	0	8	6	89	14	60	91	80	**349**
ESAF	0	0	0	0	20	6	2	5	2	0	**35**
EUR/NAT	321	441	707	454	393	531	408	355	2 358	778	**6 746**
MID	2	7	8	148	60	2	14	0	53	41	**335**
NACC	0	0	2 155	7 354	262	57	164	107	15	56	**10 170**
SAM	0	0	0	6	59	10	96	98	128	40	**437**
WACAF	0	0	0	14	3	27	1	2	5	1	**53**
TOTAL	**324**	**448**	**2 870**	**7 984**	**803**	**722**	**699**	**627**	**2 652**	**996**	**18 125**

Table 2 – number of released 5LNC

2.3 Based on 10 years ICARD statistics, a future global average need of approximately 4000 new codes per year is projected. Initial studies have shown that the current 5LNC scheme may provide adequate name-codes for next 5 to 10 years. For various reasons, it is extremely difficult to determine exactly when the capacity limit will be reached. Factors contributing to the uncertainty are:

2.3.1 ICARD database maintenance activities have revealed that a significant number of name-codes used worldwide are still not recorded in the central register. A systematic recording of such codes as well as the need to reduce name-code duplicates will affect the number of assignable codes.

2.3.2 Pronounceability and free of ambiguity in radiotelephony communications is highly subjective and depends in particular on the native language of the persons performing the assessment.

2.3.3 The need to avoid sound-like codes (same pronunciation but different spelling, e.g. "Proceed direct ALECS" or ALEKX, ALECX, ALLEX, ALIKS, ALIKX, ALICX, ALLIX, ALYKS, ALYKX, ALYCS, ALYCX, ALLYX…) affects considerably the number of assignable name codes.

2.3.4 When implementing major changes in airspace design, and in particular during the transition phase, additional name codes may be required. Current ICAO provisions advise that when there is a need to relocate a significant point, a new name-code shall be chosen. Also, in cases when a State wishes to keep the assignment of specific name-codes for reuse, such name-codes shall not be used until after a period of at least six months.

3. WAY FORWARD

Medium-term solution

3.1 It is proposed to review the different coding principles for the identification of significant points with the view to extend the lifetime of the current scheme while maintaining continuity and supporting global interoperability. Ongoing work in ICAO needs to be concluded and made available for implementation. Further work is in particular required to:

a) review the operational use of 5LNC especially when not used for radio communication (for example: pronounceable codes shall only be assigned when such 5LNC are intended to be used in radio communications);

b) study the feasibility of transferring codes in ICARD between regions; and

c) research the impact of other limiting factors, such as FMS database memory capacity.

Longer-term solution

3.2 For a longer-term solution, addressing in particular capacity and performance limitations of the current system, a more fundamental change is required. Future provisions should promote an intensified use of digital data in a service-oriented environment and allow implementing new and enhanced capabilities. In particular, any future solution should support improved machine-to-machine exchange of aeronautical information in a structured format based on widely used information technology and provide a means for aeronautical database users and application software to properly identify, access and update information.

3.3 In contrast to today's use of so-called "natural keys" (i.e. 5LNC), a future solution should, for feature identification, rely on Universally Unique Identifiers (UUIDs) which are commonly used to identify information in computer systems. A UUID created in accordance with standard methods, is for all practical purposes unique, without depending for its uniqueness on a central authority or coordination between parties generating them.

3.4 An example 128-bit UUID used in the Aeronautical Information Exchange Model (AIXM) is "a82b3fc9-4aa4-4e67-8def-aaea1ac595j". The size of such UUIDs could prove problematic since it would not be suitable for human-to-human interactions. UUIDs are not intended to replace pronounceable 5LNCs, which will remain in use when human intervention is required. However, with the use of UUIDs a strong barrier against misidentification of aeronautical features in system-to-system interactions would be established.

3.5 AIXM supports UUIDs, which are defined in three compatible standards: ISO/IEC 11578:1996 / ITU-T Rec. X.667, ISO/IEC 9834-8:2005 and IETF RFC 4122. However, UUID generation and transactional processes have not been sufficiently standardized in aviation yet to allow their operational use. For example, current implementations in aviation differ slightly and it has not yet been resolved how UUIDs are retained throughout the data chain.

3.6 Once aviation's use concept of UUIDs is sufficiently mature, it can be used to guarantee that the correct aeronautical feature is invoked when called independent of natural keys since such a selection would primarily rely on a feature's UUID. Such identifier for significant points would make it much simpler and less error-prone to invoke the correct features in system-to-system interactions (e.g. through datalink), even if two significant points existed in a database that shared the same 5LNC.

3.7 Lastly, UUIDs would prove problematic in today's flight management systems (FMS). Performance and memory capacity limitations of FMS are a bottleneck. The increasing number of PBN procedures is already overwhelming the memory capacity of many FMSs. Using UUIDs would aggravate that problem even further. Since FMS are part of a certified airframe, they cannot simply be upgraded. A platform standard is required to enable cost effective updates of avionics systems. Conforming to such a standard would ensure that FMS is architected to work across multiple avionics implementations, reducing test time and ultimately increasing rapid, affordable implementation of new and enhanced capabilities. Also, size and speed limitations of today's datalink technology may prove to be an issue in the additional use of UUIDs for feature identification.

4. CONCLUSION

4.1 The current ICAO scheme used for the identification of significant points is considered not sufficient to address long-term needs including the necessity to foster an airspace design based on a performance-based infrastructure.

4.2 Providing a long-term solution to overcome limitations of the current navigational reference system and to promote implementation of new and enhanced capabilities is a highly complex problem, which requires a coordinated effort by all aviation stakeholders at national, regional and global levels. The development and implementation of such an alternative concept is very time consuming and work should be initiated at the earliest possibility.

4.3 The conference is invited to agree to the recommendations as contained in the Executive Summary.

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