International Civil Aviation Organization

MIDANPIRG AIM Sub-Group

Third Meeting (AIM SG/3)
(Cairo, Egypt, 15 - 18 May 2017)

Agenda Item 4: AIM Planning and Implementation in the MID Region

INDICATION OF SPEED RESTRICTION ON CHARTS AND CODING TABLE

(Presented by UAE)

SUMMARY

This working paper recommends a method of charting of speed restrictions on terminal procedure charts in a consistent way with the existing publication requirement for the associated textual or tabular description of the procedure. Moreover, based on the rationale described in the body of this document, the WP is compelling the charting requirements for speed limitation information in order to be addressed for standardization to the appropriate ICAO Panel.

Action by the meeting is at paragraph 3.

1. INTRODUCTION

1.1 The implementation and expanding growth of RNAV concept has meant that many pilots now habitually fly all instrument flight procedures using guidance based upon the on-board navigation database, regardless of whether the procedures are published as RNAV or conventional. However, to be well noted, that not all conventional procedures are capable of being coded and have properly reflected the IFP intention into the navigation databases.

1.2 According to ICAO PANS-OPS, Doc. 8168, Vol. II, an accurate, complete and explicit description of an RNAV procedure is an essential publication requirement for database coding. This is achieved by the combination of an appropriate chart i.e. “graphical” depiction of the procedure tracks together with an additional textual/abbreviated or tabular description in order to be used by the database coding experts. The textual or tabular description of the procedure are solely to support the procedure encoding by the aviation industry in order to achieve an unambiguous “translation” of the textual description, procedure and its routes depicted on the charts into a code suitable for navigation systems. There is no intention that the procedure “coding tables” should be part of any flight documentation in the cockpit.

2. DISCUSSION

Overview

2.1 Doc. 8168, Vol II, Part III, Section 5, Chapter 1, paragraph 1.5.5 provides the guidelines to use an abbreviated (condensed) description method by placing the waypoint/leg constraints i.e. speed, track, turn direction and/or altitude in square brackets. The waypoints or legs are listed in consecutive order based on the "logical" flight sequence. Each constraint is coded in the format UNNNNNCD where U may be one of the following letters:

A = Altitude (feet)
F = Flight Level
K = IAS (knots)
M/T = Degrees Mag/True respectively

NNNNN is a number from 000 to 99999

C may be one of the following:

"+" for 'at or above'
"-" for 'at or below'
a blank space for 'at'

D is used to indicate turn direction:
L for 'Turn left'
R for 'Turn right

For the purpose of this paper, we will emphasize the symbols for indicating only the speed restrictions in database coding in combination with its unit of measurement (K) as follows:
"+" for 'at or above'
"-" for 'at or below'
a blank space for 'at'

2.2 In the similar context of depiction on charts of the leg/waypoint limitations (if applicable), ICAO Doc 8168, Vol. II, Part I, Section 4, Chapter 9, Table I-3-5-1 as well as Annex 4, Appendix 2 are providing a standard for charted altitudes and flight levels as indicated below:

Table I-3-5-1. Charted altitudes/flight levels

Altitude/Flight level "Window"	17 000 10 000	FL220 10 000
"At or above" altitude/flight level	7 000	FL60
"At or below" altitude/flight level	5 000	FL50
"Mandatory" altitude/flight level	3 000	FL30
"Recommended" procedure altitude/flight level	5 000	FL50
"Expected" altitude/flight level	Expect 5 000	Expect FL50

2.3 To be mentioned that both charting representation for Altitude/FL and coding table symbology for speed restriction in ICAO SARPS are basically following the "Altitude Description/ALT DESC" and "Speed Limit Description (SLD)" fields respectively as laid down in ARINC 424 industry standard specification for Flight Management System (FMS).

2.4 The ARINC 424 SLD field definition content is shown below:

Field Content Value	Description
@ (blank)	Mandatory Speed, Cross Fix AT speed specified in Speed Limit
+ (plus)	Minimum Speed, Cross Fix AT or ABOVE speed specified in Speed Limit
- (minus)	Maximum Speed, Cross Fix AT or BELOW speed specified in Speed Limit

Problem statement

2.5 Unfortunately, ICAO SARPS do not include charting provisions and appropriate symbology for speed restrictions indication. Neither Annex 4, Chapter 9 (Standard Departure Chart/SID), Chapter 10 (Standard Arrival Chart/STAR) and Chapter 11 (Instrument Approach Chart/IAC) specifications respectively, nor dedicated sections in respect of publication of Departure, Arrival and Approach Procedures (Conventional and RNAV) in Doc. 8168 PANS-OPS are not including any requirement for charting (if applicable) speed limitation on charts.

Rationale to update charting Specs on speed restriction

2.6 In the past, ICAO Standards and Recommended Practices for each chart type and their content were exclusively located in the dedicated chapters of Annex 4 "Aeronautical Charts". Later on, especially with the introduction of RNAV procedures, the charting specifications were complemented in Doc. 8168 PANS-OPS by specially created "Publication/Promulgation" sections specific to each procedure type. Moreover, the "Promulgation concept" has been continuously extended from, initially RNAV only, to Conventional and Helicopter procedures. Therefore, today, the charting requirements reside, de facto, in the following ICAO documents: Annex 4, Doc. 8697 "Aeronautical Charts Manual "and Doc. 8168, Vol. II PANS-OPS.

2.7 Furthermore, by performing a quick review of Doc. 8168 PANS-OPS, there were found several sections in the Part I (General), Part II (Conventional Procedures) and Part III (RNAV Procedures) where it is required that procedure charts shall be annotated or charting notes have to be published in regard of any speed limitation deviating from the standard speed value for a certain aircraft category, phase of flight e.g. turning departure, continuous descent arrival, specific procedure segment e.g. intermediate missed approach, final segment or even specific coding Path Terminator, for example, RF leg.

2.8 For the scope of this paper, we have selected some examples from Doc. 8168, Vol. II as follows (reference to speed restriction publication is highlighted):

- **Part I (General), Section 4, Chapter 1, paragraph 1.8.7:**

Restrictions on category and IAS. Where airspace requirements are critical for a specific category of aircraft, procedures may be based on lower speed category aircraft, provided use of the procedure is restricted to those Categories. Alternatively, the procedure may be designated as limited to a specific maximum IAS for a particular segment without reference to category.

- **Part I (General), Section 3, Chapter 3, paragraph 3.3.4 c) (Turning Departures):**

Indicated airspeed: The speed tabulated for "final missed approach" in Section 4, Chapter 1, Tables I-4-1-1 and I-4-1-2 for the applicable aircraft category, increased by 10 per cent to account for increased aircraft mass at departure. However, where operationally required to avoid obstacles, reduced speeds not less than 1.1 times the IAS tabulated for "intermediate missed approach" in Section 4, Chapter 1, Tables I-4-1-1 and I-4-1-2 may be used, provided the procedure is annotated "Departure turn limited to _____ km/h (kt) IAS maximum".

- **Part I (General), Section 4, Chapter 6 (Missed Approach Procedure):**

Indicated airspeed (IAS): The speed for final missed approach is shown in Tables I-4-1-1 and I-4-1-2 of Chapter 1. However, where operationally required to avoid obstacles, reduced speeds as slow as the IAS for intermediate missed approach may be used, provided the procedure is annotated "Missed approach turn limited to _____ km/h (kt) IAS maximum."

- **Part I (General), Section 4, Chapter 2, paragraph 2.1.1.8 (Arrival/CDO):**

Procedure design should consider the environmental and efficiency advantages afforded by implementation of a continuous descent operation (CDO). Airspeed and altitude/level restrictions, if any, should be included. These should take into account the operational capabilities of the aircraft category involved, in consultation with the operators.

- **Part II (Conventional), Section 4, Chapter1, paragraph 1.5.2 (Airspeeds Holdings)**

The speeds upon which the holding area is based should be published.

- **Part III (RNAV), Section 3, Chapter 1 (Speed limit on RF leg):**

The height above the aerodrome and the associated design IAS value at the end of the RF leg shall be based upon a climb gradient along the nominal track as determined by the designer but not lower than 10 per cent. A speed limit may be promulgated for the end of the RF leg if a smaller radius is required.

2.9 In summary, Doc. 8168 PANS-OPS has considerable number of indications that speed limitations being part of instrument flight procedure design considerations have to be "communicated" through charts to the users' community (pilots, ATC, military). According to the same document, the procedure designer should take into consideration all details of any specific restrictions applied to a procedure that shall be published in order to ensure unambiguous translation of the design into the navigation data base.

2.10 In consequence, we are considering that provisions of speed limit charting specification together with an adequate symbol for representation on charts are more than necessary.

2.11 In addition, a lack of provisions of symbolic representation for speed restriction on charts is compelling the data originators (DOs) use their best possible ways to describe speed restriction on charts. But, this is creating a confusion for data houses. Adopting a symbolic abbreviation will harmonize and standardize coding and chart of speed restrictions and it will be very clear to follow.

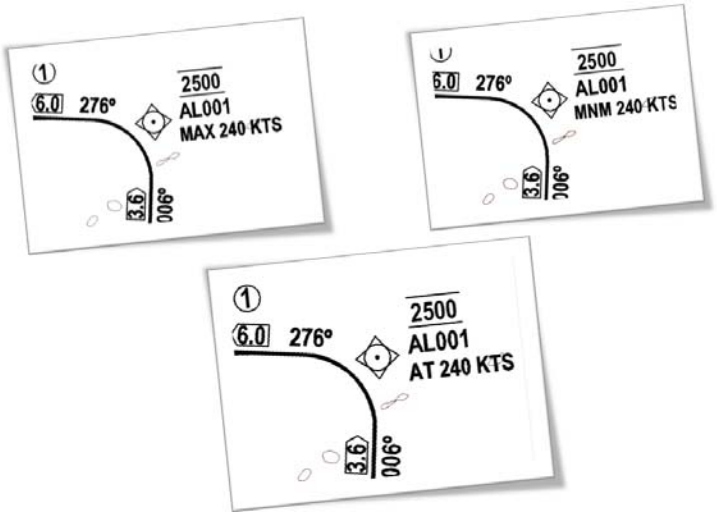
Proposed way forward

2.12 In order to address the indication of speed restrictions on charts, our recommendation is to follow an harmonized and consistent approach with the existing ICAO chart depiction for

Altitude/FL as well as in line with industry standard ARINC 424 which is summarized in the table below:

ARINC 424, field 5.261	On chart (Example)	Coding Table
Minimum Speed, Cross Fix AT or ABOVE speed specified in Speed Limit	MNM 240 KTS	+240
Maximum Speed, Cross Fix AT or BELOW speed specified in Speed Limit	MAX 240 KTS	-240
Mandatory Speed, Cross Fix AT speed specified in Speed Limit	AT 240 KTS	@240

2.13 Accordingly, the graphical portrayal with the abbreviation MAX, MNM and AT indicating the "maximum", "minimum" and "At" speed restrictions respectively are proposed as depicted below:



2.14 After internal coordination with the data originators, UAE is intending to adopt the proposed method progressively for future amendments.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note and review the contents of this working paper;

b) consider the proposed charting solution for indicating speed limitation information; and

c) consider addressing the paper for further action to the appropriate ICAO Panel.

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