International Civil Aviation Organization
South American Regional Office
Eleventh Workshop/Meeting of the SAM Implementation Group (SAM/IG/11) – Regional Project RLA/06/901
(Lima, Peru, 13-17 May 2013)

SAM/IG/11-WP/23
03/05/13

Agenda Item 3: Implementation of performance-based navigation (PBN) in the SAM Region

PBN AIRSPACE

(Presented by LATAM Airlines)

SUMMARY

It is a known fact that PBN is a fundamental tool for improving the use of available airspace. Consequently, it is of essence to have an open mind and try to plan, almost from scratch, new paths and improvements that may have a positive impact on the TMAs of the Region.

REFERENCES:

- ICAO Doc 9613, PBN Manual, Advance fourth edition (unedited)
- ICAO Doc 9992, "Manual on the use of Performance Based Navigation (PBN) in Airspace Design"
- ICAO Doc 9931 "Continuous Descent Operations (CDO) Manual"
- ICAO Doc 9993 "Continuous Climb Operations (CCO) Manual"

ICAO Strategic Objectives:	*A - Safety* *C - Environmental protection and sustainable development of air transport*

1 Background

1.1 Last March, thanks to the joint action of ICAO and IATA, members of the Region participated in a "PBN Airspace Workshop" conducted in Miami. The activity brought together members from all areas of the aeronautical community involved in the implementation of the new procedures, in a setting of teamwork and exchange of knowledge and experiences.

1.2 As an airline, it was an honour and a pleasant experience to participate in this activity that has heightened the interest and conviction of the organisation in the notion that there is still much to be done and many opportunities for improvement awaiting implementation, especially in the TMA setting, since much has already been done en route.

2 **Discussion**

2.1 During the Workshop on PBN Airspace, thanks to the brilliant presentations made by the highly qualified instructors, it was possible to reflect upon, and exchange ideas about, the many topics related to PBN implementation in TMAs that are so important for operators, and which should be highlighted and shared:

- **Joint participation:** it is fundamental to take into account the opinion and experience of all the parties in order to achieve the best results. The designers, ATC and operators always have something to contribute in a successful implementation. In many countries, working groups that include regulators, ANSPs and operators have already been established to jointly develop tasks and concepts.

- **Controlled airspace volumes:** Due to the establishment of new paths using PBN SIDs and STARs, it is necessary to reconsider the extent of TMAs and controlled airspace required to accommodate the new procedures. The TMA must be adjusted to the new paths and procedures and not the other way around, so as to obtain as many optimum descent and climb profiles as possible to accommodate the different types of FMS systems and performance of the aircraft considered in the implementation.

- **Radar sector minima:** there are radar minimum charts that have not been modified for a long time and which could be revised to give more consistency to the new paths likely to be published, especially in the case of RNP AR APCH which, many times, is applied in areas not previously contemplated (see example in **Appendix A**).

- **Location of holdings:** from the point of view of fuel efficiency, it is very important that holdings be always planned at more than 8000 FT (*e.g.*, a A320 burns 2153Kg/hr in a HLDG at 5000 ft and 2026Kg/hr at 20000 ft).

- **AIRAC cycles:** since PBN procedures can only be flown from the Navigation Database (NavDB), it is fundamental to respect AIRAC cycles and publish the charts duly in advance so that the new procedures may be included in the NavDB.

- **Increase available airspace:** many times, the TMA contains airspaces that are not used or are underutilised, in which, prior to PBN, it had not been possible to implement conventional instrument procedures. It is important to analyse such airspaces with PBN in mind, to see if there is any possibility of introducing improvements to increase their capacity (see example in **Appendix B**).

- **Revise existing descent profiles for CDO implementation purposes:** even if a PBN arrival path is laterally similar to the existing conventional one, it is now possible to improve descent profiles using RNAV1 and RNP1 protection areas, in order to obtain operational benefits related to CDO implementation. Many times, these areas are much smaller and make it possible to disregard obstacles that result in demanding profiles in mountainous areas. The descent in the more modern aircraft is less than 3°, in many cases close to 2° (see example in **Appendix C**).

- **Navigation database capacity:** there is no doubt that the implementation of the new PBN procedures is providing many benefits to users. However, a limitation must be considered: the capacity of many navigation databases, especially the older ones, is being exceeded by the publication of these new procedures, since the FMS was not designed to

accommodate the sustained growth of procedures and airways at the rate at which they are being published worldwide. Consequently, a fundamental task for States and air traffic services is to eliminate from the publications those procedures no longer being used and/or that not even serve as backup for the structure normally used in a TMA. As an example, the storage capacity of a legacy B767 of the 90s is only 400KB, a modern A320 has 20MB, the A380 has 30MB, and future developments speak of 100MB, much less than what one might imagine.

3. **Suggested action:**

3.1 The Meeting is invited to take cognizance of the ICAO Manuals under reference and take them into account when developing new procedures. Likewise, when reviewing old procedures, airspace planners and instrument procedure designers should analyse such Manuals in order to make good decisions in future implementations. The Meeting is also invited to view the specific items mentioned in this paper as opportunities for improvement that will benefit all those involved in PBN.

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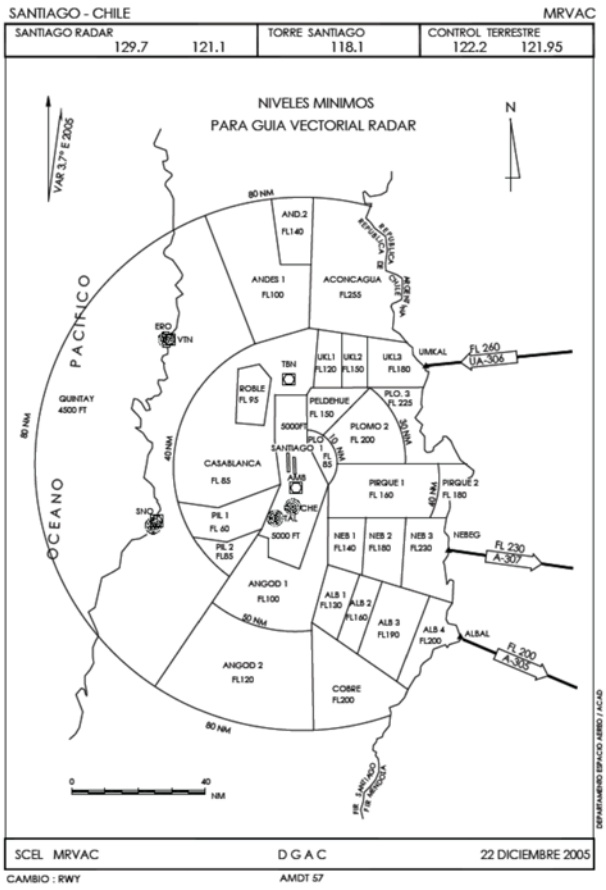
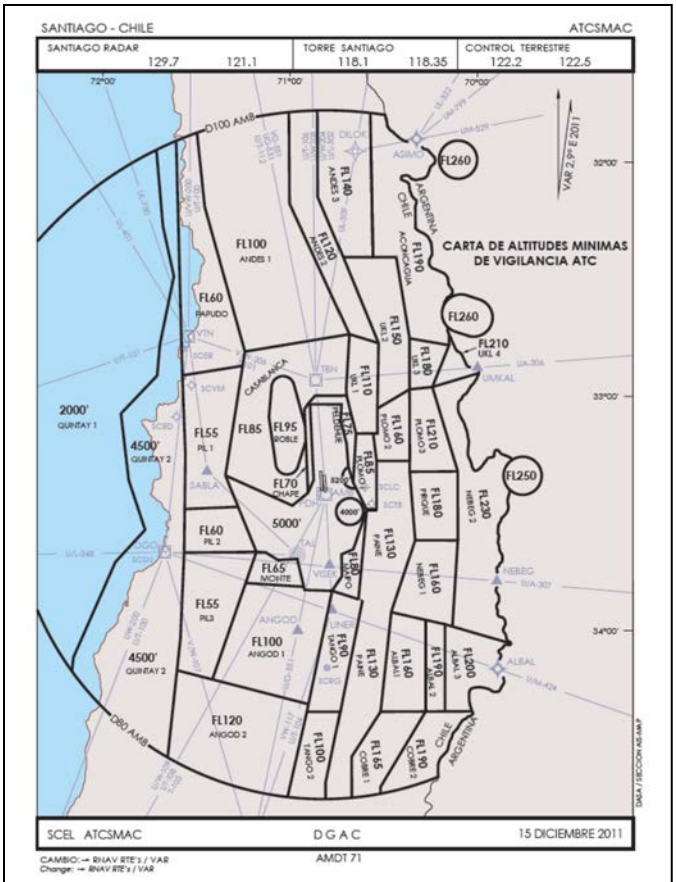
APPENDIX A

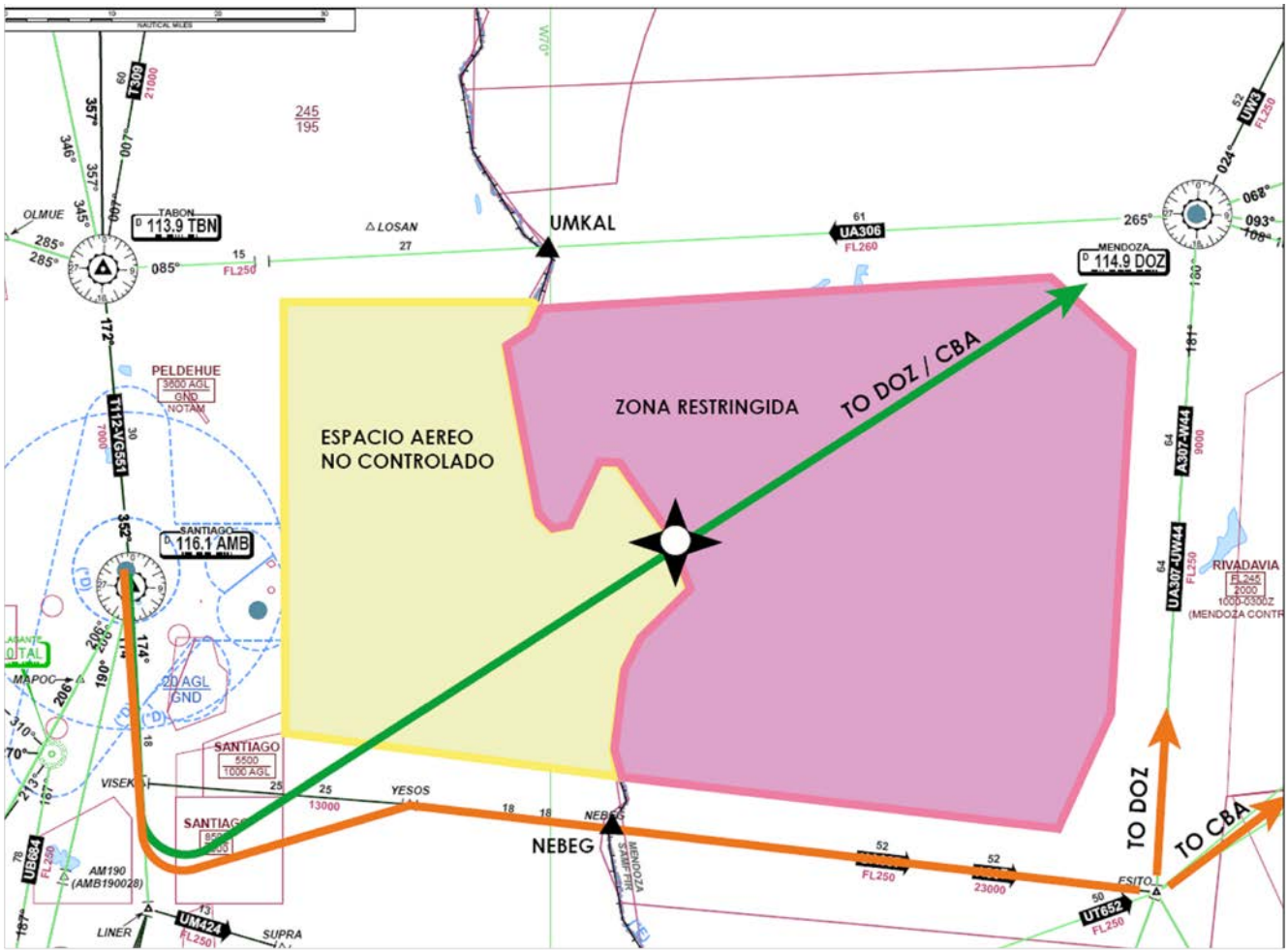


Old SCEL minima sector chart



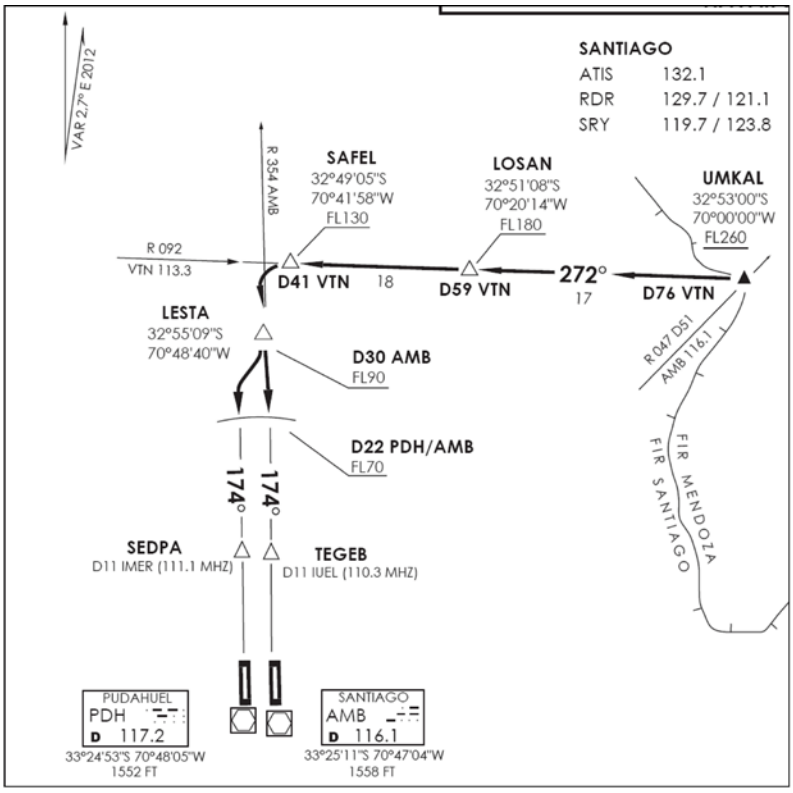
Revised sector minima chart improving specially sector ASIMO whcih was implemented to admit climb and descent from/to new RNAV regional AWYs which were published.

APPENDIX B

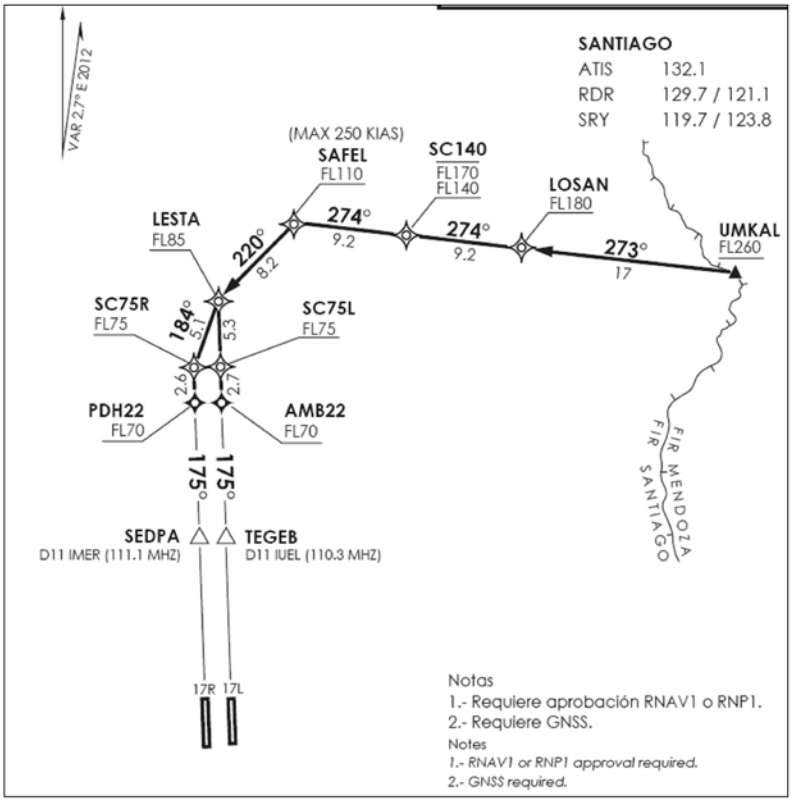


The crossing from SCEL to DOZ/CBA was always done based on ground aids, reason why the airspace between UMKAL and NEBEG was never used. Through a SID PBN and the flexible use of airspace, the possibility of a shorter and efficient route could be explored.

APPENDIX C



The crossing from Argentina is based on a VOR VTN radial; there is no lower AWY as the upper AWY has a FL260 MEA; Monte Aconcagua is located more than 10 Nm of UMKAL. If the Navaid is out of service, there is no AWY nor descent procedure available.



A STAR PBN provides Independence from gound aids, reduced protection areas and the possibility to improve descent profile. It is even feasible to cross UMKAL at a lower level (FL210 or FL230), as Monte Aconcagua does not penetrates the protection area.

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