

FIRST WORKSHOP ON PBN AIRSPACE DESIGN IN THE SAM REGION

Summary

The First Workshop on PBN Airspace Design in the SAM Region was held in Bogota, Colombia, from 12 to 23 May 2014, under the sponsorship of the Unidad Administrativa Especial de Aeronautica Civil of Colombia and the support of RLA/06/901 Regional Project – “Assistance in the implementation of an ATM regional system according to the ATM operational concept and the corresponding technological CNS support”, in response to ICAO Assembly Resolution A37-11, adopting the global implementation of Performance Based Navigation (PBN).

Taking into consideration Conclusion SAM/IG/11-1 (*Support to SAM States in the redesign of their TMA*), it was deemed advisable to plan activities of RLA/06/901 Project for 2014, in order to identify needs and extend training to ATM experts in the SAM Region, to support and facilitate PBN regional implementation plan, by increasing participants knowledge regarding application of PBN.

During the SAM/IG/12 Meeting (Lima, Peru 14 to 18 October 2013), it was concluded that the most beneficial would be to conduct the required training in three consecutive phases:

The **first phase** consists of on-line training obtaining basic PBN concepts through the ICAO website (<http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx>) and the study by each one of the participants of the following PBN-related manuals: PBN Manual (Doc 9613), Manual on the use of PBN in airspace design (Doc 9992), Continuous Descent Operations Manual (Doc 9931) and Continuous Climb Operations Manual (Doc 9993).

The **second phase** consists of participation in the Workshop I on PBN Airspace Design, during two weeks, which objective is to provide theoretical/practical training on PBN Terminal Area design, selecting for the practical exercise one high complexity TMA and one medium/simple TMA. Terminal Areas selected to conduct such exercise were Bogota and Asuncion, respectively.

The **third phase** includes the participation in Workshop II on PBN Airspace Design, during one week, where the participants of the First Workshop present the basic preliminary design for one TMA selected for each State, so that it may be harmonized and optimized during the workshop using the techniques of the First Workshop, pursuing as well an integration of entry and exit points of these TMAs with a view to elaborate Version 3 of SAM ATS Route network.

The First Workshop on PBN Airspace Design in the SAM Region was attended by 43 experts of 10 States and 8 experts of the industry (Airbus and IATA). Participants were representatives of aviation authorities, air navigation services providers as well as civil and military air operators of the South American Region. Overall, participants were experts in specialties such as air traffic control, airspace planning, instrumental approach procedures, pilots, airline operations technicians/engineers, aircraft dispatch, AIS experts, air navigation inspectors and aeronautical cartography.

During the opening of the PBN Workshop, the Director of the Unidad Administrativa Especial de Aeronáutica Civil (UAEAC), Dr. Gustavo Lenis Steffens, welcomed the participants. Mr. Julio Pereira, ATM/SAR Regional Officer of the ICAO South American Regional Office briefly explained the objectives of the workshop, thanking the aviation authorities of Colombia for their efforts made to carry out this important event, which is part of the regional strategy for achieving the goals of the Declaration of Bogota.

The instructors of the Workshop were the following:

Mr. Julio de Souza Pereira, ICAO ATM/SAR Regional Officer;
Mr. Roberto Arca Jaurena, ICAO ATM/SAR/AIM Regional Officer;
Mr. Jorge Fernández Demarco, former ICAO ATM/SAR Regional Officer, ATM Advisor;
Mr. Fernando Hermoza Hübner, Technical Coordinator of Air Navigation, DGAC Peru;
Mrs. Mariela Valdés Piña, Chief Airspace Project, LAN Airlines, LAN base of maintenance.

The first activity of the Workshop was to identify the level of knowledge of participants, with an initial test which roughly assessed several of the topics which would be delivered during the workshop. In this regard, the Group achieved an average of 75%, 87% of them ranging between the concept of good and regular.

The Workshop was developed on **31 Modules**, which contemplated the theoretical part, including 20 modules with presentations made by instructors and 11 intended for submissions from States and IATA. Moreover, **43 Modules** of exercises were given, where each one of the theoretical classes were practiced. For the development of the Workshop, 61 effective hours of training were given, excluding coffee breaks and lunch time.

In **Module 1 – General overview of the Workshop**, the prospects of the workshop were explained, deeply analyzing the scope and objectives of same, especially emphasizing those related to the use of PBN in airspace design, review of the main points in ICAO relevant documentation (Doc. 9613, Doc. 9931, Doc. 9992 y Doc. 9993), share lessons learned, train experts to develop and apply PBN action plans in their States, as well as participate appropriately in the regional PBN implementation processes, train participant experts for them to replicate the knowledge in their States as well as develop preliminary PBN designs of Asuncion and Bogota TMAs.

Module 2 – SAM implementation strategy, reviewed SAM implementation strategy for the PBN implementation, explained the vision and mission of ICAO, especially emphasizing the optimization of operations in all phases of flight, in order to take advantage of these features to improve efficiency and safety. ASBU concerning PBN implementation was briefly analyzed.

Module 3 – Overview of PBN and airspace concept, was focused in the relationship between PBN and airspace concept, explaining the application of navigation specifications and air navigation infrastructure and how a specification should be selected according to its use, either in ATS, SID/STAR routes and/or approach procedures. The meaning of an airspace concept as well as the reasons for its development was also recalled. Through such concept a structured and systematic way is provided to determine what should be achieved in an airspace and how should it be achieved to help ensuring that the objectives and expected benefits for the new structure of airspace are clearly established, the objectives in the change in airspace are achieved as well as the means to achieve the objectives are appropriate and feasible with the available resources.

Module 4 - Manual on the use of performance-based navigation (PBN) in the airspace design (Doc. 9992), referred to the use of performance-based navigation (PBN) in the airspace design, Doc. 9992, explaining in detail the four phases of the implementation process: Planning, Design, Validation and Implementation, as well as the 17 macro activities to achieve the established objectives. The importance of initiating a project of airspace structuring for the

application and use of PBN, maintaining a strong coordination with the whole ATM community and particularly, with the users of airspace was stressed, as such coordination would allow an early explanation of what would be the scope and objectives of PBN implementation project. Afterwards, all activities described in Doc 9992 were explained one by one.

In **Module 5 - CDO Manual (Doc. 9931)** and **Module 6 - CCO Manual (Doc. 9993)**, implementation processes of continuous descent operations (CDO) and continuous climb operations (CCO) encompassed in Documents 9931 and 9993 respectively, were explained. Both manuals and therein contained designs were reviewed, assessing the techniques for their application as well as the specific requirements for this kind of operations. Particularly, a review was made on the main benefits to be obtained from its application, identifying in the case of continuous descent operations, the increase in flight predictability, airspace efficiency and safety, while reducing fuel consumption, CO₂ emissions, pilot/ATC workload and CFIT. On the other hand, the implementation of CCO techniques offer advantages such as operations with improved fuel performance, reduced pilot/ATCO workload, reduced communications, cost savings and environmental benefits (lower consumption, noise mitigation) and, if applicable, authorizations for operations which otherwise, may be restricted by noise.

Module 7 – Designing routes-Route spacing, encompassed aspects related to the design and route spacing. Regarding the design, an evaluation was made on the type of specification that should be used, depending of the phase of flight, which would be the requirements of airspace concept and under which circumstances it would be necessary or not, to carry out an on board performance monitoring and alert, particularly taking into account that navigation specifications not include all airspace requirements needed for the operation in an airspace, route or procedure in particular. Applicable procedures must be inserted in AIP and/or Regional Supplementary Procedures or other documents of the State and States must conduct a safety assessment in accordance with the provisions of Annex 19 and PANS-ATM. It was also clarified that the PBN Manual is not a document of certification/approval. Its purpose is to harmonize, so each State must publish its own document, reminding at this point that the SAM Region counts with the Advisory Circulars of the Regional Safety Oversight Cooperation System, for aircraft approval in the different navigation specifications to be applied. Regarding route spacing, the generic model to determine separation and spacing between routes was analyzed, and different types used worldwide were provided for information. Finally, in this module information and explanation was given on the different separations included in Amendment to Doc 4444, which application begins on November 2014.

Module 8 – Good design practices had as main objective to explain general PBN good design practices. Regarding the considerations for the design, it was indicated that design should be based on reality, i.e. the location of the airport, terrain and optimal altitudes of aircraft. It was also stressed that the reality is the originator of LOAs and not the other way round, as well as the requirement to determine optimal crossing points concerning routes. On the other hand, always related with the considerations for the design, there was also indicated the need to start with the shortest routes, or with those that occupy less the sector, try to balance the ATC intervention with the required distances and consider links with the structure of conventional routes. It was especially remembered that RNAV/RNP aircraft will require less ATC intervention, that RNAV/RNP routes contribute to safety and that no RNAV/RNP aircraft probably will have to be vectored to assure harmonization and safety within a given airspace. In this same module, different arrival and departure paths that could be applied in the optimization of airspace were largely explained.

Module 9 – Data required for airspace planning, covered general aspects related with the data required for airspace planning. In such sense, the need to know the reference scenario, i.e. the present scenario, initially based on TMA dimensions, geographical coordinates, prohibited, restricted and dangerous areas in a radius of 100 NM from the center of main airport, geographical limitations, total number of airports served by the terminal, etc. was thoroughly

explained. It was also encouraged to identify main traffic flows, entries, exits, pairs of cities served and ATS routes, assess aircraft fleet, their characteristics and navigation capacities, see or identify delays and its reasons, etc. Finally, some examples on data processing for terminal areas were delivered.

Module 10 – Designing airspace volumes and sectors, aimed at providing an understanding of airspace volumes and sectors, to be considered in the design process. It was indicated that the airspace of one TMA area should be only enough to cover departure and arrival operations. Some rules were presented to define sectors that should be taken into account during planning. Among others, it was stressed on the need that the number of sectors should be the minimum required for different situations and the number of conflicts per sector and time unit should be minimized. Also, the number of sectors crossed by each aircraft and the time of permanence of aircraft in one sector should be the minimum possible. Different ways to establish or define sectors using geographical or functional areas, as well as their advantages and disadvantages, were also presented.

Module 11 - Introduction to exercise and **Module 12 - Generic airspace exercise**, contemplated presentation of basic material to be used on the first exercises. This generic airspace design exercise focused on the Centerville TMA. In order to perform this exercise, fictitious information on TMA, as well as sufficient information to understand the operation of such TMA was provided. The exercise requested to establish concepts and to design a new Centerville TMA, by applying the good design practices for departures, arrivals and holds which were explained on previous module. A description of the case was delivered referring to ATM concepts, airspace, meteorology, aircraft types, major flow paths, existing infrastructure on communications, navigation and surveillance, environmental and social aspects, special use areas, etc. Participants were requested to design a new TMA, define airspace volume as well as sectors related to such TMA. Finally, the Group was invited to show the work carried out in a PPT presentation, applying all the base material provided to this point of the workshop.

From this module, presentations and exercises made by the Group were developed intending that each lecture was followed by a practical exercise, in order to enlarge on what was learned.

Module 13 – Safety criteria and assumptions, focused on safety criteria, providing an overview on safety criteria, performance and related policy. In general terms, explanation was given on why to establish safety criteria as well as on the difference between safety qualitative and quantitative assessments. Subsequently, explanation was also given on the 7 steps of a risk analysis and the probability, severity and tolerability matrix proposed by ICAO for the risk analysis, as well as the criteria to be used in each case. The importance in an implementation programme to conduct an analysis before implementation, preferably during the planning phase as proposed by Doc 9992, and after implementation, in order to assure that the system maintains or improves levels of safety, was highlighted.

Module 14 – Validation and implementation, focused attention in aspects related to validation of airspace concept and routes (routes themselves / departures / arrivals / approaches) and resulting instrument flight procedures. The objective of this module was to show the importance of validation, which in general terms allow assess whether the ATM objectives will be achieved, check the flyability of instrument flight procedures, identify potential problems and develop mitigations, provide evidences that the design is safe and above all, explain that validation is an ongoing process throughout the project life. Information on the different methods of validation for both, airspace and instrumental procedures, while showing the advantages and disadvantages of each one of these methods, was also delivered.

Module 15 – Introduction to Asuncion and Bogota case study, was initiated with the presentation made by the representatives of Paraguay and Colombia, giving details of their terminal areas Asuncion and Bogota respectively, these being the two case studies to be

analyzed by the workshop. Both presentations focused in providing as much information as possible regarding size of the TMA, with geographical coordinates and vertical TMA dimension, prohibited, restricted and dangerous areas in a radius of 100 NM from ARP of main airport, geographical limitations, runways, type of control service provided, radar coverage, main traffic flows based on data collection form, standardized entries and exits, main city pairs served by ATS routes, main airports in TMA (indicating identification, extension, aircraft category allowed, runway capacity), aircraft type operating the airport, navigation capacity of the aircraft fleet operating in the airport. If there are delays, identify reasons (due to ATC, MET conditions, airlines, etc.), indicate potential traffic conflicts within TMA (bottlenecks / points of conflict), maps of ATS routes, number of TMA overflights and any other information which was useful for the analysis of airspace in each case.

Continuing with Module 15, a brief summary was made on the topics seen so far, based mainly on the 4 phases of Doc 9992 implementation process. Based on the presentations made by Paraguay and Colombia, clear information was submitted, explaining the Group what was expected and informing that tasks would be divided into 7 different working groups. Task 1 expected to establish operational requirements and its scope. Task 2 asked to undertake a review of the reference data. Task 3 requested for the identification of interferences, enablers and project constraints. On the other hand, task 4 asked for the identification of routes and departure/arrival points to terminal areas. Task 5 focused on the identification of at least two main flows for departure and arrival, as well as a preliminary draft of IFR procedures. Task 6 was related to airspace volumes and sectors. Finally, task 7 requested the groups to perform a final presentation of the result achieved. Before the final presentation, the groups presented the progress made after each task performed.

Module 16 – Practical effects of path terminations application in procedures and use of FOQA data, covered the use and meaning of each one of the path terminations usable in RNAV/RNP procedures. In addition, it showed how FOQA data can help monitor post implementation of a procedure. Examples were shown on the use of path terminations that did not achieve the desirable or optimal path and why such paths were not optimal. Likewise the navigation accuracy achieved by aircraft by using this data was observed.

Module 17 – Publications and database - Best practices, presented publications requirements to achieve a good coding in navigation databases. Reference was made to aeronautical data chain and the time required for encoding, the data required in coding tables, RF sections publication, 5LNC and alphanumeric way-points naming, magnetic variation applied to RNAV sections as well as RNP, APCH and RNP AR APCH.

In **Module 18 - RNP AR access and efficiency**, it was discussed about the general characteristics of these approaches and the transition concepts for the application of such approaches, as currently benefits can be obtained on its implementation without being specifically implemented in response to geographical obstacles. Moreover, different examples were shown on implementation and difficulties for its application in congested terminals.

In **Module 19 - IFSET tool**, the ICAO tool for the calculation of fuel saving was presented. Practical examples were submitted. Explanation on access to the tool and its corresponding user guide was also given for its use by experts.

Module 20 – Project management action plan, covered aspects related to the meaning of a project, explaining that it is a temporary effort made to create a unique product or service, or to concrete a certain goal. It was also explained that the project should clearly define the objectives, deadlines and resources, its intention to produce a specific result at a given time, within an established budget, and that same could cross organizational lines. On the other hand, an overall explanation was given on how to manage a project and the importance of identifying all stakeholders, determine needs, define their requirements, lead and influence them, as well as

to balance the scope, time, cost and quality of the project, emphasizing that it is a set of processes that requires expertise in several areas of knowledge. Some critical aspects or factors that could affect a project were identified and the importance of time management in order to achieve expected results was also underlined. Finally, participants were given an example of generic action plan, with possible dates for the development on a PBN airspace implementation project, in order to facilitate the development of national action plans for the design of their airspaces with PBN application

In addition to theoretical/practical workshop activities, participants had the opportunity to receive another 5 presentations, with a view to obtain information on the experiences and lessons learned from other States and IATA during the planning, design, validation and implementation of their respective airspaces. In such sense, Brazil, Chile and Peru made their presentations and delivered the Group valuable information on their experiences, highlighting such aspects to be taken into account that might have affected the implementation in their respective States. On the other hand, IATA presented an analysis of the reports received from international operators regarding incompatibility of ATC gradients in SIDs with aircraft performance. IATA informed that in current FMS, it is necessary to count with accurate models for calculating acceleration segments and configuration changes from take-off. In such sense, IATA recommends operators to carry out a preliminary study considering tools like “climbout” for the path calculation, delivered by the aircraft manufacturers. Moreover, Mr. Mauricio Corredor, member of the delegation of Colombia, offered the participants a detailed presentation on the Fast Time Simulator (FTS) recently acquired by the civil aviation, as well as the on the potential of this tool for airspace optimization in the terminal area of Bogota.

Regarding the exercises developed during the workshop, from the second day on the practical phase began in both, generic aspects of design as in the phase design of Asuncion and Bogota TMA. Participants were divided into two working groups that were maintained throughout the workshop. In such sense, following exercises were developed by each one of the groups:

1. TMA – Generic airspace exercise.
2. Group work – Operational requirements and scope.
3. Group work – Review of reference data.
4. Group work – Interferences, enablers and constraints.
5. Group work – Routes, arrival/departure points and holds.
6. CDO/CCO exercises.
7. Group work – IFR preliminary procedures.
8. Group work – Airspace volumes and sectors.
9. Preliminary design of airspace (Asuncion). Group final presentation.
10. Preliminary design of airspace (Bogota). Group final presentation.

The result was a preliminary design of terminal areas Asuncion and Bogota, which will serve as reference material for the planning, design and implementation of PBN in their respective States, to be presented during the development of the Second Phase of this workshop, to be held in September 2014.

The last day of the workshop, a final test was taken in order to identify the progress of participants in the knowledge obtained during the event. The details of the evaluation are attached as **Appendix A**.

In summary, the results were:

- a) Average group qualification: 89.
- b) At the end of the workshop, all participants were rated as good (between 70 and 84) or very good (more than 84).
- c) No participant obtained a final qualification under 72.

- d) The group average increased by 13.5 points (from 75.5 to 89), comparing the initial and final assessments.

Moreover, a survey was conducted to measure the degree of satisfaction of participants with reference to the workshop and the instructors. Details of the survey are attached as **Appendix B**. The summary of the results was as follows:

- a) 87% of participants rated the workshop as excellent, while 13% rated it as good.
- b) 91% of participants rated the instructors as excellent, while 9% rated them as good.

APPENDIX A

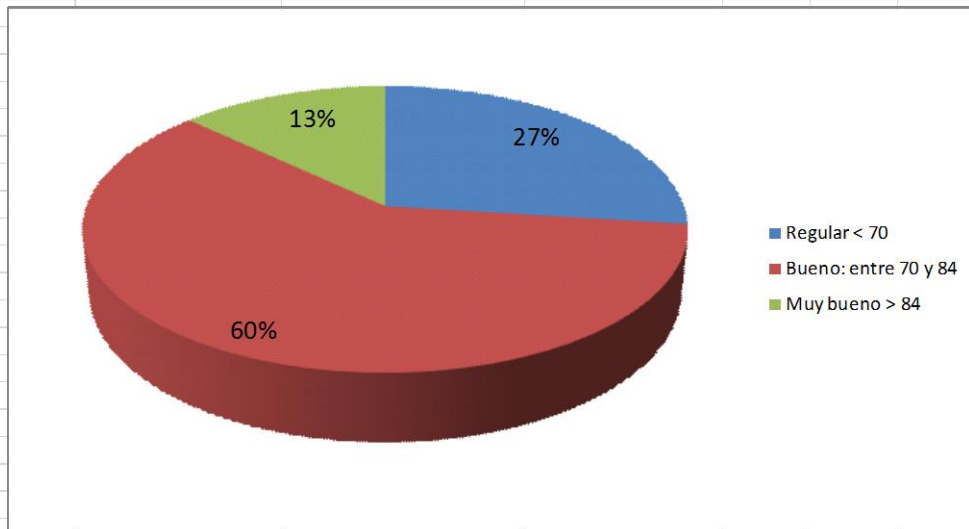
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COMPARATIVE RESULT OF
INITIAL AND FINAL EVALUATION

INITIAL EVALUATION OF WORKSHOP

Note 1: 47 participants took the initial evaluation.

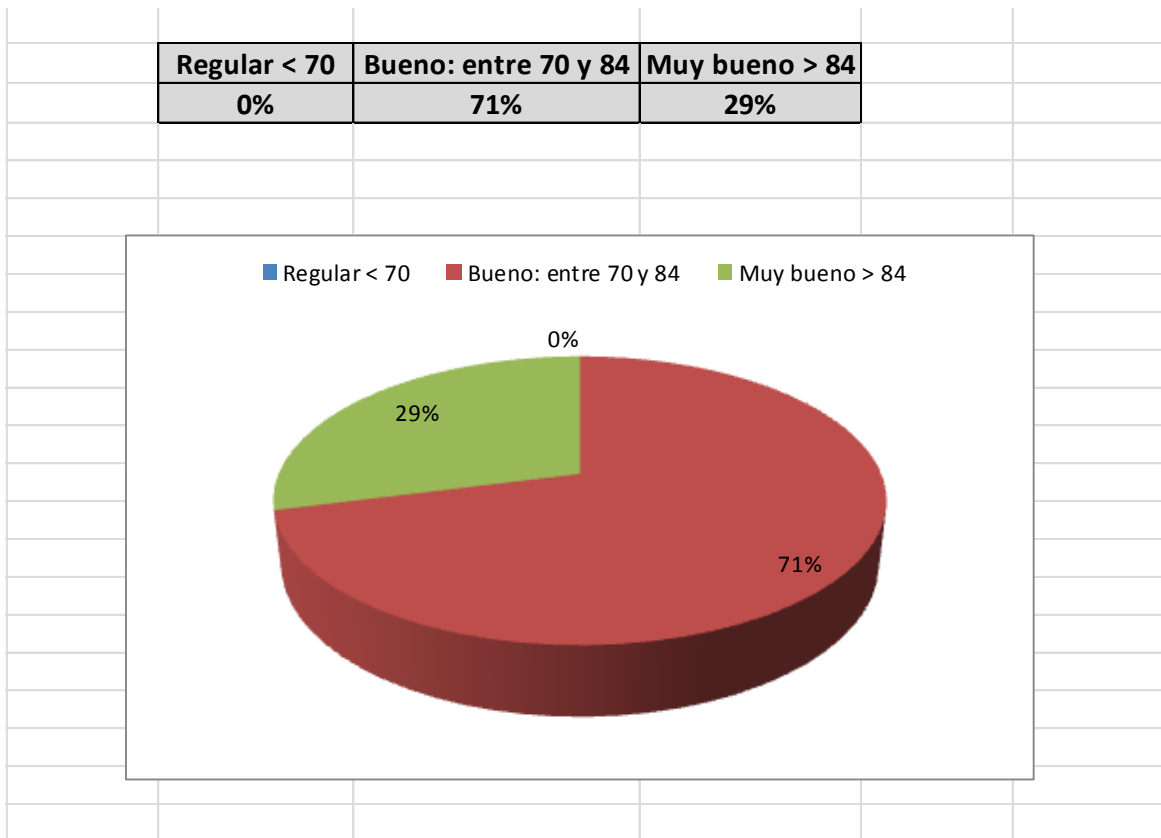
Regular < 70	Bueno: entre 70 y 84	Muy bueno > 84
27%	60%	13%



GROUP AVERAGE QUALIFICATION: 75.5

FINAL EVALUATION OF THE WORKSHOP

Note 2: 42 participants took the final evaluation.



GROUP AVERAGE QUALIFICATION: 89

- AT THE END OF THE WORKSHOP, ALL PARTICIPANTS WERE RATED AS GOOD OR VERY GOOD.
- NO PARTICIPANT OBTAINED A FINAL QUALIFICATION UNDER 72.
- THE GROUP AVERAGE INCREASED BY 13.5 POINTS (FROM 75.5 TO 89).

APPENDIX B

FIRST WORKSHOP ON
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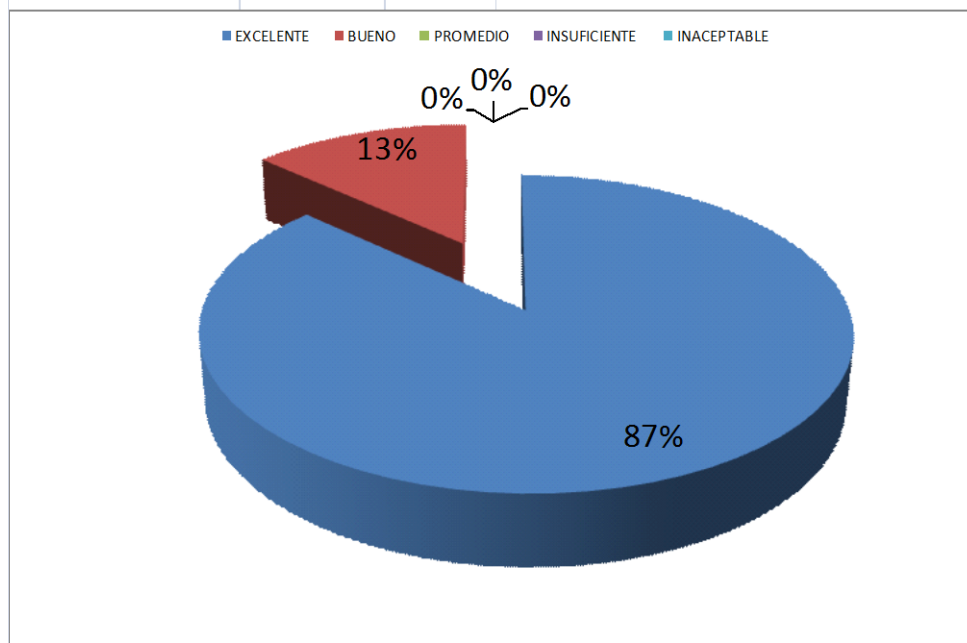
RESULT OF THE SURVEY

EVALUATION OF THE COURSE CONTENT

Clasificación: **5** = Excelente / **4** = Bueno / **3** = Promedio / **2** = Insuficiente / **1** = Inaceptable)

Evaluación del contenido del curso	
Los temas tratados son actuales.	5.00
¿Como califica el programa de capacitación del Taller PBN?	4.82
¿Cómo califica el material de capacitación?	4.84
Se refuerza la teoría impartida con ejercicios y prácticas.	4.84
Se vincula los temas con la realidad y/o su aplicación en casos reales.	4.87
¿Cómo califica el nivel de información?	4.87
¿El taller ha atendido sus expectativas?	4.84
¿La información suministrada es suficiente para llevar a cabo el plan de implantación PBN en su Estado o Empresa?	4.66
¿El material y la información suministrada en el taller permitirían que se dicte un curso/taller similar en su Estado o Empresa?	4.66
	4.82

EXCELENTE	33	87%
BUENO	5	13%
PROMEDIO	0	0%
INSUFICIENTE	0	0%
INACEPTABLE	0	0%
	38	100%



EVALUACION OF THE INSTRUCTORS

Clasificación: 5 = Excelente / 4 = Bueno / 3 = Promedio / 2 = Insuficiente / 1 = Inaceptable)			
Evaluación de los instructores			
Facilitan la comprensión de los diferentes temas presentados			4.53
Estimulan la participación y el trabajo en equipo.			4.47
Motivan los participantes en los diferentes tópicos del curso.			4.55
Mantienen el orden y el control del horario establecido.			4.47
Hacen uso adecuado de las ayudas didácticas y de las instalaciones.			4.45
promedio			4.49

EXCELENTE	32	91%
BUENO	3	9%
PROMEDIO	0	0%
INSUFICIENTE	0	0%
INACEPTABLE	0	0%
35	100%	

A 3D pie chart illustrating the distribution of instructor evaluations. The chart is divided into five segments: a large blue segment for 'EXCELENTE' (91%), a smaller red segment for 'BUENO' (9%), and three very thin segments for 'PROMEDIO' (0%), 'INSUFICIENTE' (0%), and 'INACEPTABLE' (0%). A legend at the top of the chart area identifies the colors for each category.

What suggestions can be offered to improve the workshop?

- Always maintain performance in radar; the participation of Mariela Valdes is invaluable.
- Highlight and discuss certain very important. Sometimes people's interpretation may vary.
- The workshop was conducted flawlessly, exceeding my expectations. I have no suggestions.
- Overall, very good contents and organization on the part of the instructors. Just to improve, presentations could be optimized in some cases.
- Working groups should not be involved by many people, as participation could be distorted.
- I would like to have more working hours with Mariela Valdes, regarding design and calculation of gradients and climbs.
- I believe that all was very well.
- Fewer participants or divided into more groups. Practice focused in training of participants and not in the implementation of a State, in order to homogenize more the knowledge. Increased participation of instructors in practice.
- Divide the groups into more than two, in order to allow more people to participate.
- Try to work in smaller groups to facilitate the performance.
- In view of the quality of the event, if there has been something to improve, it would be very minimal.
- In order to improve work, I suggest that exercises are developed in Leticia TMA, with the data submitted by instructors. For larger groups do not become a subdivision.
- Two suggestions. During the practice, a fictional TMA is considered, so that everyone can get the same level of knowledge and all concepts are applied. To divide the groups into smaller parts. In our case, 4 groups would be good.
- As lived experience in C.A., would suggest ATC involvement from the beginning of the design until activity 14 – implementation.
- To consider training courses, as the level of participants is not the same. To consider other scenarios (airports), of other States, to receive support from specialists of the Region.
- To improve training in IFSET.
- Would suggest that groups were smaller. Two or three groups working on a same topic and then cross information.
- Through the experience gained on workshops and based on the observations made after each presentation, plus the contributions of each State, it could be considered to provide a more comprehensive guide on the process to follow as well as on the provision of deliverables. That is, a kind of list of activities.
- Due to noise, the auditorium was used only by one group to carry out the work. The rooms assigned to the other group did not allow proper display of projections and only a limited number of outlets were available.
- Maintain the same group of instructors. It is difficult to improve them.

Comments

- Control the logistics, so that all groups have equal physical conditions (facilities). Control internet services.
- Very good lecturers. Congratulations.
- I consider the level at which topic was discussed was excellent. Requires more disclosure and support from all involved areas in order to achieve implementation in shorter periods.
- The professional level of instructors is excellent. All expectations were met.
- Keep it up! Excellent job!
- In order to carry out the implementation plan, it would be convenient to receive training in Project management in each State.
- Excellent and very practical workshop, with high level lecturers, according to company's needs.
- To thank the dedication to us.
- The workshop exceeded my expectations.
- Excellent hosting State. Excellent instructors' academic level.
- Congratulations to all the team for their dedication and commitment.
- Excellent workshop and congratulations to the instructors for their dedication.
- High quality and experience in the instructors' team. Scenarios treated (Bogota and Asuncion), were ideal for its complexity and traffic density. Hopefully such seminars are repeated more often. Congratulations.
- Some design problems require internet. Connection should be improved.
- The workshop was a success. Updated in the global context. Enables to observe details that will be used in the PBN design in my State.
- All was excellent. Hope to continue taking into account the Central American Region.
- That SAM Office supports States which require training in procedure design.
- As far as possible, supply more information regarding RNAV and conventional flight treatment in a same scenario, specially referring to separation criteria that should be applied by air traffic controllers.

-END-