



International Civil Aviation Organization

SEMINAR ON THE ECONOMICS OF CNS/ATM

Casablanca, 28-30 October 1997

REPORT

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT ON SEMINAR ON THE ECONOMICS OF CNS/ATM¹

(Casablanca, 28 to 30 October 1997)

1. Introduction

1.1 A Seminar on the Economics of the Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) Systems, convened by ICAO for States in Africa and the Middle East, was held in Casablanca from 28 to 30 October 1997.

1.2 The Seminar was the second of its kind and the first for the States covered, intended to provide guidance to States on cost-effectiveness, and financial and related organizational and managerial aspects of implementation of the ICAO CNS/ATM systems.

1.3 Attending the Seminar were 141 participants from 24 Contracting States and 8 international organizations. The complete list of participants appears in **Appendix 1**.

1.4 The Seminar was opened with a welcoming address by His Excellence the Minister of Transport, Merchant Marine, Tourism, Energy and Mines of Morocco, Mr. Driss Benhima, who accredited ICAO as the only body capable of realizing the necessary international understanding of the standards and operational practices as well as the international acceptance through its member States. He also called upon an extended co-operation at the regional level in order to reduce as much as possible the constraints of onboard equipment that are evolving between different regions, and to reach a harmonization of the future operational methods, as well as taking advantage of the economy of scale of equipment.

1.5 The Secretary General of ICAO, Mr. R.C. Costa Pereira, declared in his opening address that through the application of satellite technology States can ensure that air navigation services are provided at a cost which is much less than that required for conventional systems, and that the net benefits to the users (primarily the airlines) will exceed the net costs to the systems providers (primarily the States) by a considerable margin. He also emphasized that the implementation of CNS/ATM systems does not change the responsibility of the States for the provision of air navigation services according to Article 28 of the Chicago Convention but makes it less costly for States to meet their obligations. Finally, he referred to the *World-wide CNS/ATM Systems Implementation Conference*, which ICAO would be convening in Rio de Janeiro in May 1998, where the main objective would be to provide guidance and develop recommendations on how financing can be secured, how cost recovery can proceed and repayment of loans be ensured, and how States can co-operate in the provision and operation of CNS/ATM systems components.

1.6 Opening addresses were also given by the Director General of ONDA (National Airports Authority of Morocco), Mr. Ahmed El Biaz, and the President of ICAO's Air Navigation Commission, Mr. Victor Aguado. ONDA is a public establishment for airports and airspace management and Mr. El Biaz referred to a number of its projects in the air navigation field, which takes into account the

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This report was prepared by the Secretariat after the conclusion of the Seminar.

ICAO European (EUR) and African (AFI) regional air navigation plans as well as the Global Co-ordinated Plan for Transition to the ICAO CNS/ATM Systems and the AFI CNS/ATM Implementation Plan.

1.7 Mr. Upali Wickrama, Chief of the Forecasting and Economic Planning Section of ICAO, acted as Moderator of the Seminar and Mr. Östen Magnusson, Economist in the Airport and Route Facility Management Section, served as its Secretary.

1.8 The programme for the Seminar was as follows:

- Opening of Seminar
- CNS/ATM systems elements overview
- Planning process
- Organizational issues
- Cost-effective implementation
- Financial performance
- Cost recovery
- Funding
- Briefing on the 1998 CNS/ATM Implementation Conference
- Summary, conclusions and follow-up actions

In addition Secretariat staff were available and met interested participants for follow-up consultation on specific issues and for "hands-on" familiarization with CNS/ATM cost/benefit software.

1.9 The working languages of the Seminar were English, Arabic and French. The programme, together with certain ICAO publications relevant to the various subjects (a list of which appears in **Appendix 2**) constituted the documentation for the meeting. In addition, printed versions of presentations where available were distributed during the Seminar in the original language of each presentation.

2. CNS/ATM systems elements overview

2.1 Mr. Judimar Chagas, Chief of the ICAO Communications, Navigation and Surveillance Section, described the main features of the CNS/ATM systems as well as the status of technical and operational developments. He emphasized that:

- there is a need for modernization of the system in order to overcome the limitations of the existing system and to cope with current and future air traffic demands;

- the expected benefits will not materialize until there is a full exploitation of the new technologies both in the air and on the ground;
- implementation of CNS/ATM elements will not take place at the same time in the different regions but will come through gradually based on global and regional planning; and
- implementation will not make all conventional systems obsolete overnight but will rather build on existing technologies.

2.2 Concerning planning activities under way, Mr. Chagas pointed out that planning has to be carried out at global, regional and national levels and that the States themselves have the ultimate responsibility for implementation. The importance of co-ordination, co-operation and partnership was highlighted as in many situations they will be the key to successful implementation of the CNS/ATM elements. Mr Chagas also advised participants of the current updating of ICAO's *Global Co-ordinated Plan for Transition to the CNS/ATM systems* and that the major tasks of the ICAO standardization work (development of SARPs and procedures) with regard to CNS are expected to be completed by 1999. Finally, he concluded that the transition period to the new systems would have to be as short as possible in order to minimize the costs but sufficiently long so as not to compromise agreed levels of safety.

3. Planning process

3.1 On behalf of ICAO's regional offices in Cairo, Dakar and Nairobi, Mr. G. P. Moshabesha presented the AFI CNS/ATM Implementation Plan, which had been adopted by the AFI/7 Regional Air Navigation Meeting in May 1997. He highlighted the plan to divide the region into ten homogeneous areas of routing corresponding to the major traffic flows. A set of ATM objectives had been defined for each area of routing. On the basis of these objectives the required communications, navigation and surveillance systems will be derived taking into account the nature of the area (continental or oceanic), the existing systems and the improvements which could be introduced during the time frame of the plan (1995-2005). Mr Moshabesha also highlighted some implementation steps already taken or in progress in the AFI region. Concerning guidance to States and users for the implementation of airborne equipment and ground system elements he referred to the AFI Implementation Plan. He explained the three documents forming the AFI CNS/ATM Implementation Plan.

3.2 Mr. Abdenabi Manar, Administration of Civil Aeronautics of Morocco, presented the AEFMP Plan, which is an air navigation systems harmonization plan for Algeria, France, Morocco, Portugal and Spain. The need for this plan had emerged from the ECAC and EATCHIP work in Europe and the need for France, Portugal and Spain to co-ordinate their planning activities with neighboring States in the AFI region. The plan covers not only harmonization of technical systems and air traffic management but also harmonization of training and working methods. It includes two periods: an initial period up to 1998 and a medium and long-term period for 1998-2000 and beyond.

3.3 The user perspective on the planning process was provided by Ms. Véronique Vincent from IATA. She explained that the benefits to airlines from CNS/ATM implementation could include airspace capacity, reduced fuel burns, reduced flight time with its many implications, reduced contingency fuel requirements, reduced delays and reduced technical fuel stops. As the airlines would have to invest between

\$250,000 and \$1 million per aircraft, Ms. Vincent emphasized that the benefits would need to be demonstrated, including a clear commitment by the provider States, prior to airlines showing willingness to invest.

4. Organizational issues

4.1 Mr. Östen Magnusson described the structure, ownership and control of air navigation services in general and the various options available in connection with the implementation of CNS/ATM in particular, including international operating agencies and other co-operative efforts such as joint financing arrangements and multinational facilities. He gave an overview of the Danish and Icelandic joint financing agreements and the recent arrangement on the joint financing of a North Atlantic height monitoring system, as an example of one possible option to assist in the implementation of CNS/ATM. Concluding his presentation Mr. Magnusson emphasized the availability of guidance material from ICAO on these issues, including a report of the Air Navigation Services Economics Panel (ANSEP) on *Financial and Related Organizational and Managerial Aspects of Global Navigation Satellite Systems Provision and Operation* (Doc 9660) and the new *Manual on Air Navigation Services Economics* (Doc 9161/3).

4.2 On behalf of the Legal Bureau of ICAO, Mr. Magnusson addressed some legal aspects of CNS/ATM. Most importantly, he drew attention to the general conclusion that there are no legal obstacles to the implementation of CNS/ATM and no inconsistency with the Chicago Convention. He introduced the draft *Charter on the Rights and Obligations of States Relating to GNSS services* developed and adopted by the Panel of legal and technical experts during their second meeting in October 1997.

4.3 Mr. Youssouf Mahamat, representing Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), presented the various projects related to the implementation of the CNS/ATM systems of relevance for regional co-operation within the framework of ASECNA. He also described the origin and evolution of the organization and its role as a regional model for air navigation co-operation. With regard to the implementation of the CNS/ATM systems Mr. Mahamat identified ASECNA's role as covering the following issues: design, realization, management, involvement, training, institutional, financing and assistance.

4.4 Mr. David Featherstone of the International Mobile Satellite Organization (Inmarsat) described Inmarsat as an international Treaty organization where the principal participants and owners are post, telegraph and telephone system (PTTS) providers and national telecommunication agencies from some 80 States. Inmarsat's function is to provide space segment for mobile satellite communications services world-wide for the maritime, aeronautical and land-mobile communities. The space segment is available to all States without discrimination and the aeronautical system is dedicated to the community of aeronautical users. Considering its services Inmarsat could, according to Mr. Featherstone, be regarded as a wholesaler of the space segment to the owners and operators of ground earth stations (GES), the latter which are the organizations in the respective States that actually are the signatories of Inmarsat. To provide global services GES owners have often teamed together into consortia, and entered into commercial arrangements with specialized aeronautical communication service providers (e.g. SITA). Also, Mr. Featherstone focused on the special services to air traffic management and the support services for satellite navigation. For the far term future he foresaw a possible transition to AMSS systems using satellites in non-geostationary orbits. Mr. Featherstone concluded that there are no capital investment requirements on States for communication satellites or their support infrastructure.

4.5 For Société Internationale de Télécommunications Aéronautiques (SITA), Mr. Kieran O'Rourke provided the Seminar with a detailed description of SITA and the CNS/ATM communications services and products it does or can provide. He explained that SITA is an international not-for-profit co-operative instituted by the airlines for the purposes of providing telecommunications to the airlines. Its activities have now been expanded to provide services to civil aviation administrations and air traffic services providers.

5. Cost-effective implementation

5.1 Mr. Upali Wickrama outlined the objectives of cost/benefit analysis and measures of economic viability such as the benefit/cost ratio, rate of return and, in particular, Net Present Value (NPV) which covers the whole life cycle of an investment including transition from an existing system. He explained that NPV calculations would help demonstrate the financial return that could be expected from investments in CNS/ATM, and could also be used to determine the most cost-effective implementation strategy. Mr. Wickrama described the methodology, the year-by-year evaluation of costs (in terms of equipment, services and training) and benefits (in terms of avoided costs of present technology, savings to operators and, to the extent that they may be considered measurable, passenger time savings), and the discounting procedure to present actual costs and benefits. The aggregation of all the costs and benefits (in present value terms) produces a single net present value figure which is a measure of the financial viability of the transition to the new systems in the particular airspace being analysed. It was emphasized that the costs associated with CNS/ATM will depend on the choice of implementation options. The net present values of the various implementation options can be compared in order to determine which option is the most cost-effective.

5.2 The *Economics of Satellite-Based Air Navigation Services - Guidelines for cost/benefit analysis of communications, navigation and surveillance/air traffic management (CNS/ATM) systems* (ICAO Circular 257) was promoted together with computer spreadsheets, which were available within ICAO, to assist States in carrying out NPV analysis for CNS/ATM. These spreadsheets were demonstrated to several groups of participants during the seminar using practical examples.

5.3 In an air transport outlook Mr. Wickrama described the historical development of air traffic and the financial performance of the airline industry. He also introduced ICAO's latest long-term traffic forecasts, which clearly indicate continuing growth in all regions, with aircraft movements now growing in close step with passenger traffic rather than more slowly as in the past.

5.4 Mr. David Diez, Spain, presented a case study carried out by AENA (Aeropuertos Español y Navegación Aérea) with the objective of determining the economic feasibility and financial implications of implementing the CNS/ATM systems in Spain. In the study the guidelines and methodology contained in the *Economics of Satellite-based Air Navigation Services*, ICAO Circular 257, had been applied. Cost data had been provided by some 85 manufacturers and in addition experts from a number of international organizations had been consulted. Twelve alternative technological scenarios had been considered where the differences were related to communications and surveillance. All alternatives showed positive net present values for both the ATS service provider and the users, with an overall net present value in the most profitable scenario at US\$ 389 million (with an additional US\$ 823 million if passenger time savings are considered). However, Mr. Diez concluded that a regional cost/benefit analysis might be more useful in order to achieve the best possible solution for all the States in a region.

5.5 Based on the guidance in ICAO Circular 257 Mr. Wickrama discussed some aspects of case studies in general. He pointed at results from studies made for United States (Oceanic areas) and India (from the airlines point of view), which both indicated that the implementation of the CNS/ATM systems would be cost-beneficial.

6. Financial performance

6.1 Mr. Upali Wickrama called attention to the need to distinguish in cost/benefit analysis between air carrier cost/benefit and State-as-provider cost/benefit, since they would be significantly different and would define the parameters of cost recovery by States through, for example, user charges on carriers. He also addressed the important issue of rate of return, which is a key measure of financial performance used by financial institutions in assessing applications for funds.

7. Cost recovery

7.1 Mr. Östen Magnusson spoke about cost recovery policy and mechanisms, placing particular emphasis on the *Statements by the Council to Contracting States on Charges for Airports and Air Navigation Services*, (Doc 9082/5) which were widely followed by States, and the associated guidance in the new *Manual on Air Navigation Services Economics* (Doc 9161/3). He also described how to determine the costs involved and their allocation to civil aviation among user States, at the state level to non-aeronautical use, between airport and en-route utilization and finally among categories of air navigation services users.

8. Funding

8.1 As an introduction to this issue Mr. Östen Magnusson addressed CNS/ATM systems financing in the context of financing other air navigation services, basic issues related to financing air navigation services, the relevance of financial and economic analysis and the need for and form of a financing plan. Mr. Magnusson also identified the various means of funding and sources of funds, differentiating between domestic, foreign and other sources. The five most relevant sources for the CNS/ATM systems were expected to be direct contributions from government(s), debt financing, internally generated resources, equity financing and leasing.

8.2 Mr. Manfred Krüll, Deputy Director of ICAO's Technical Co-operation Bureau, described the structure and organization of ICAO's technical co-operation programme and the services offered by ICAO. Among typical ICAO projects that he mentioned were establishment, organization and operation of autonomous authorities; establishment of regional and sub-regional air navigation services; development and implementation of State-operated user charges collection systems; and development of CNS/ATM implementation plan, including cost-benefit and cost-recovery analyses. As most of the challenges in civil aviation that the States around the world now have to face no longer can be met at State level, Mr. Krüll suggested that ICAO would be the natural partner in assisting recipient States and to advise donor and funding organizations on the optimal investment of funds dedicated to civil aviation.

8.3 Mr. M.D. Sangare of the African Development Bank (ADB) Group declared that civil aviation needs to co-operate at the regional level in order to mobilize resources and to utilize more effectively the new technology, and that the issue of privatization is gaining practical importance as a mechanism for mobilizing resources for investment. Mr. Sangare also described the role of the bank group

and identified the various kind of projects in the civil aviation sector that it had financed. Since 1984 there had existed a co-operation agreement between ADB and ICAO, and since 1994 also a Memorandum of Understanding signed in order to facilitate collaboration between them.

8.4 Mr. Edgar Saravia of the World Bank focused on privatization as a solution to financing, noting that governments were not always achieving full cost recovery for air navigation facilities at present. He gave some examples of corporatization or privatization of air navigation services around the world. He stated that it is essential to redefine the role of the States and separate regulatory functions from operating functions, where in the latter case an increased private sector participation would secure the funds necessary for the investments needed. Mr. Saravia also invited ICAO to become a partner with the World Bank to ensure full compliance of all air transport regulations and standards by developing the conditions for increased private sector participation in the funding and operation of the sector.

9. Briefing on the CNS/ATM Implementation Conference

9.1 Mr. Judimar Chagas informed about the structure of the *World-wide CNS/ATM Systems Implementation Conference* to be held in Rio de Janeiro from 11 to 15 May 1998, referring to the invitation sent out in State letter M 8/1-97/89 of 17 October 1997. He explained that the main idea with the conference was to address the financial issues and to convince the States and the financing institutions that the time for implementation had come. In parallel with the conference there would be an exhibition to demonstrate that the technology is already available.

10. Summary, conclusions and follow-up actions

10.1 As a part of the summary of the meeting, Mr. Philippe Jacquard, France, described the experiences so far by France related to the implementation of the CNS/ATM systems, the main problem in congested areas being lack of capacity and in less congested areas lack of flexibility.

10.2 A panel of the speakers was set up to reply to questions on operational/technical, financial and training issues. Here the question was raised as to what funds that were available for implementation of CNS/ATM. In addition to the general classification of sources of funds identified by Mr. Magnusson above, the following foreign governmental financing sources were given as examples: World Bank Group, African Development Bank, European Development Fund, Islamic Development Bank, specific aid programmes which certain governments have established to promote economic and social development in various areas of the world and special export-promoting agencies of certain governments, e.g. export-import banks. Mr. Magnusson explained that cost/benefit analyses, cost recovery and autonomous authorities were all important factors when seeking funds for the implementation of CNS/ATM.

10.3 It was also questioned whether a State still would have to implement the CNS/ATM systems if a cost/benefit analysis showed a negative result and/or if all the benefits would go to the users. Mr. Wickrama emphasized the importance to look at the CNS/ATM systems as a package for civil aviation from a regional point of view. In the case where the users would gain significant benefits while the providers would experience net costs, adjustments should be made to the air navigation services charges. Co-operation, at a regional or a sub-regional level, through for example an international operating agency or a joint charges collection agency would facilitate the recovery of costs for the States involved.

10.4 In light of the on-going discussion concerning privatization of ATM (ATS) providers, compared to establishment of public autonomous authorities, it was suggested that the effects of privatization should be seriously analyzed, specially considering the development of international operating agencies for future ATM services.

10.5 In concluding the Seminar Mr. Wickrama made a summary of what had been presented under the various programme items, enclosed in **Appendix 3**. He also referred to the CNS/ATM Implementation Conference in Rio de Janeiro 1998 where the financial issues would be discussed next. At the end of the meeting Mr. Wickrama conveyed his sincere appreciation to the Government of Morocco for the excellent meeting arrangements and the generous hospitality extended to all participants of the Seminar.

APPENDIX 1

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APPENDIX 2

LIST OF ICAO PUBLICATIONS

Statements by the Council to Contracting States on Charges for Airports and Air Navigation Services (Doc 9082/5)

Report on Financial and Related Organizational and Managerial Aspects of Global Navigation Satellite System (GNSS) Provision and Operation (Doc 9660)

Economics of Satellite-Based Air Navigation Services – Guidelines for cost/benefit analysis of communications, navigation and surveillance/air traffic management (CNS/ATM) systems (Circular 257-AT/106)

Manual on Air Navigation Services Economics (Doc 9161/3)
