LETTER OF TRANSMITTAL

To: President of the Council

From: Chairman of the World-wide CNS/ATM Systems Implementation Conference

I have the honour to submit herewith the report of the World-wide CNS/ATM Systems Implementation Conference, which was held in Rio de Janeiro, Brazil from 11 to 15 May 1998.

Mr. P.I. Seixas
Chairman

Rio de Janeiro, 15 May 1998

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HISTORY OF THE MEETING

1. PLACE AND DURATION

1.1 The World-wide CNS/ATM Systems Implementation Conference was held at the Riocentro Convention Centre, Rio de Janeiro, Brazil from 1000 hours on 11 May 1998 completing its agenda on 15 May 1998. Opening remarks were introduced by the Governor of the State of Rio de Janeiro, His Excellency Marcello Nunes de Alencar, and the Minister of Aeronautics of Brazil, Lt. Brigadier Lélio Viana Lôbo.

1.2 The President of the ICAO Council, Dr. Assad Kotaite, noted the importance of the conference, added his welcome to the participants and expressed ICAO's appreciation to the Government of Brazil for hosting the conference. His Excellency Fernando Henrique Cardoso, President of Brazil also welcomed the participants and declared the conference officially opened. The President of Brazil and the President of the Council of ICAO then proceeded to inaugurate the CNS/ATM Systems Exhibition organized by the Host State held in conjunction with the conference.

1.3 Mr. R. C. Costa Pereira, Secretary General of ICAO, provided an additional welcome and opening remarks to the conference and introduced the ICAO Secretariat.

2. REPRESENTATION

2.1 The World-wide CNS/ATM Systems Implementation Conference was attended by participants from 123 Contracting States, and 27 international organizations and 32 industry delegations.

3. OFFICERS AND SECRETARIAT

3.1 Mr. P.I. Seixas (Brazil) was elected Chairman, Mr. J.K. Abonouan (Côte d'Ivoire) was elected First Vice-Chairman and Mr. N. Yee (Fiji) as Second Vice-Chairman of the conference. The Secretary of the conference was Mr. J. Howell, Director of the Air Navigation Bureau and the Deputy Secretary was Mr. V. Zubkov, Chief of the Regional Affairs Office. The agenda item Secretaries were:

Agenda Item 1:	Mr. J. Howell assisted by Mr. A. Zerhouni, Mr. R. Ybarra, Mr. J.D. Chagas and Mr. V. Galotti
Agenda Item 2:	Mr.V. Zubkov assisted by Dr. M. Donato, Mr. L.B. Shah and Mr. H.V. Sudarshan
Agenda Item 3:	Dr. M. Donato assisted by Mr. V. Zubkov, Mr. Z.M. Baliddawa and Mr. U. Wickrama
Agenda Item 4:	Mr. El Hicheri assisted by Mr. P.I. Hegedus and Mr. W. Sander-Fischer
Agenda Item 5:	Dr. L. Weber assisted by Mr. A. Cheiffou and Mr. J. Huang
Agenda Item 6:	Mr. J. Howell assisted by Mr. C.H. Eigl and Mr. M. Fox
Agenda Item 7:	Mr. J. Howell assisted by all item secretaries

3.2 The ICAO Officers in charge of administrative services for the conference were:

Administrative and Conference Officer	Mr. M. Blanch
Chief, Language Services	Mr. P.J. Butler
Chief, Interpretation	Mrs. R.J. Ezrati
OAS Co-ordinator	Mrs. D. Provencher
Communications/Remote Translation Co-ordinator	Mrs. L. Dery-Crawford
Document Control Officer	Miss A.K. Craig
Printing Supervisor and Assistant Administrative Officer	Mr. J.D. Daoust
Registration Supervisor	Mrs. R. Zagoritis
Distribution Supervisor	Mr. A.N. Amaya
Public Information Officer	Mr. D. Chagnon

4. ADOPTION OF THE AGENDA

4.1 The agenda transmitted to the conference by the Council was adopted at the first meeting.

5. WORKING LANGUAGES AND ARRANGEMENTS

5.1 The working languages of the conference were Arabic, English, French, Russian and Spanish with interpretation available in Chinese. The working schedule, submitted to States in advance of the conference, was accepted at the opening meeting.

5.2 A co-ordinating group was established in accordance with the *Directives to Divisional-type Air Navigation Meetings and Rules of Procedure for their Conduct* (Doc 8143) and met throughout the conference. The members were the Secretary of the conference, the Deputy Secretary, agenda item Secretaries and their assistants and representatives of the various Secretariat services catering to the conference. The group was able to co-ordinate the activities of the conference using the services and accommodations available.

6. AGENDA

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7. LIST OF REPRESENTATIVES

7.1 A list of accredited representatives who attended the meeting appears on pages ii-[ ] to ii-[ ].

[The list of delegates will be included in the Blue Cover Edition of the report of the conference]

8. OPENING REMARKS BY THE PRESIDENT OF THE COUNCIL

"From the pioneering era until our modern times, air transport has become a mode of mass transportation and an essential element in the socio-economic development.

On my own behalf and that of the Council and the Secretary General of the International Civil Aviation Organization, Mr. Renato Cláudio Costa Pereira, and on behalf of all delegates and observers assembled here today in the great city of Rio de Janeiro, I would like to express to His Excellency Fernando Henrique Cardoso, President of Brazil, and, through him, to his Government and to the people of Brazil our most sincere thanks and appreciation for the warm welcome and hospitality extended to all of us. The facilities and services provided to the conference will contribute largely to its success.

History may well record this conference as an important milestone in the development of international civil aviation after the Chicago Convention of 1944, which erected the framework for global civil aviation. I shall explain why in a few moments.

But first, I would like to point out that this conference is unprecedented for ICAO in two important respects. For one, it is accompanied by a major Technology Exhibition, which will be formally opened by President Cardoso and myself this morning. For another, *in addition* to the representatives of ICAO Member States, governmental, intergovernmental and non-governmental organizations, the conference invites include participants not traditionally invited to ICAO meetings – notably representatives of individual manufacturers and of financial institutions from the private sector. To all of you – welcome!

Commercial air transport ranks with communications as the very foundation of our global society. The economies of many nations rest upon it. And, to an extent, the well-being of billions of human beings.

Air transport is also an industry undergoing profound changes. In our lifetime, we have seen it grow dramatically. For example, last year, more than 12,000 commercial jets worldwide operated some 15 million flights. That is six times more aeroplanes and almost eight times as many flights as there were 30 years ago. Those 15 million flights carried a record 1.5 billion passengers on scheduled services worldwide and one third of the world's manufactured goods by value.

Throughout much of the 30-year period of sustained growth I have just alluded to, the aviation environment was relatively stable. Over the past decade, however, that growth and the associated changes accelerated considerably, to the point that air travel has become an indispensable commodity. World economic and social conditions have made aviation more accessible, more dynamic and highly competitive. And yet, one thing has remained constant: the expectation of travellers to continue to fly in total safety.

These changes have made the economics of commercial air transport less stable and less predictable. Even our splendid system of air navigation, which remained relatively more stable during that time, began to experience problems coping with the constant growth in demand, and doing it safely. ICAO recognized this early on and, more than a decade ago, started the development of the communications, navigation, surveillance/air traffic management (CNS/ATM) systems.

In the intervening years, the technology of CNS/ATM systems has matured to the point where we can now look to implementation. The technology for CNS/ATM is available and, where implemented, is working well *today*. There are, however, some associated issues that need to be addressed.

During the course of our deliberations this week, let us be guided by the theme of this conference: Beyond Technology: Global Framework and Financing. Yes, there are certain legal issues to finalize, there are technical co-operation programmes to be fine-tuned, there are training programmes to be put into place. During the conference, we will be briefly exposing you to these matters.

But the critical issues remain those of a global framework and of financing. These will be our main focus. And I think you will find that with sound cost recovery and financial management of air navigation services in place, enhanced on some aspects through co-operative arrangements, CNS/ATM makes such good business sense to any investor that these critical issues can undoubtedly be overcome. Furthermore, CNS/ATM will make a significant contribution to environmental protection through reduced fuel burn.

This conference is an action-oriented meeting, one where we shall bear in mind that we share an historic opportunity – an opportunity to find ways to continue the growth, and to advance the safety of, our global civil aviation system.

In a spirit of co-operation, let us work together, grow together, help each other and set out the ways by which our goals will be accomplished!

Let us also really get to know each other – providers, users, and partners in aviation- so that we can continue to work together to build a truly global air navigation system for the common good!

Before leaving here, we will have prepared a report of our deliberations, our conclusions, and our recommendations to the Council of ICAO. Let us also consolidate these fruits of our deliberations into a Declaration of Rio de Janeiro on the Global Air Navigation Systems for the Next Century – a document which not only will provide the world's public with knowledge of what we have done, but which, even more importantly, can serve to keep us united, bound together with a common goal, continuing in a common effort.

Let us work so that history will record this gathering not as an important end-of-the-century conference on civil aviation, but, regardless of its dates, as the first great conference on our air navigation system in the 21st Century!"

9. **OPENING ADDRESS BY THE PRESIDENT OF BRAZIL**

"First of all, I would like to welcome you warmly and say that it is a great honour for Brazil to host the World-wide CNS/ATM Systems Implementation Conference.

Thanks mainly to the pioneering role played by Alberto Santos Dumont, Brazil has been associated with the advancement of aeronautics from the very start and we take pride in that.

Ever since the 14-bis flight at the Bagatelle field in Paris, on that 23 October 1906, the history of aviation has been one of courage, boldness and human ability to face challenges. It pays tribute to that enterprising sprit which leads men to the relentless pursuit of perfection and to the discovery of the new.

In less than a century, from Santos Dumont's heavier-than-air aircraft to the present day, when air travel has become the most important means of transportation between continents, the aeroplane turned from eccentric to indispensable, from precarious to reliable, from dangerous to safe, from exclusive to popular.

The intensification of air travel has naturally generated the need for an internationally accepted set of rules. Hence the signing of the Chicago Convention of 1944, and the creation of the International Civil Aviation Organization, of which Brazil is a founding member.

The fact that we have a distinguished Brazilian – Brigadier Renato Costa Pereira, as Secretary General of the Organization signifies the importance attached by the Brazilian Government to ICAO. We follow with keen interest the Organization's work and we have always sought to contribute to it to the best of our ability, in the Council and in the Air Navigation Commission, as well as in the Assembly and the various groups of experts.

By organizing this conference, ICAO renders yet another crucial service to the advancement of civil aviation, as it provides us with the conceptual basis for the implementation of the CNS/ATM system. At the same time, it helps to bring together the private sector, experts and government officials, so that a

fruitful discussion can take place on different and very important aspects of implementation – including legal, financial and operational issues – and the system can be put to work properly.

The successful outcome of your deliberations will contribute greatly to making civil aviation more practical, more reliable, safer and in a better position to meet increasing demands in terms both of quality and quantity. As we enter a new century, the aeroplane will play an increasingly important role as a means of transportation and as a tool to bring people and nations togther.

However, we know that for our multilateral efforts to bear fruit, it is essential that all country fulfill their obligations and do their "homework" properly.

Brazil has a tradition of excellence in this field. One that we cherish and constantly endeavour to honour. In the light of the country's continental size and geographical circumstances, the aeroplane soon became an indispensable tool to help us bridge the distances and carry out the vital task of national integration.

Therefore, with a view to making air travel within our territory as efficient, smooth and safe as possible, Brazil has spared no effort in the constant improvement of its air control system and in the updating of its aeronautical and airport infrastructure.

Brazil is ready and willing to exchange experiences in this field with other members of ICAO. We are convinced that it is from this common effort that effective progress will come for civil aviation – to the benefit of all our countries. One example of such progress will be the implementation of the future air navigation system, the common goal that brings us to this welcoming city of Rio de Janeiro.

The task ahead is of crucial importance to the whole international community. So good luck to you, and my wishes for every success in your endeavour."

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Agenda Item 1: Overview of CNS/ATM systems implementation

1.1 INTRODUCTION

1.1.1 Under this agenda item, the conference was presented with several theme-driven presentations which focussed primarily on the role of communications, navigation and surveillance/air traffic management (CNS/ATM) systems in global modernization efforts. Presentations were given by senior officials in civil aviation and encompassed:

a) global navigation satellite systems (GNSS), including augmentation systems;

b) policy and regional implementation issues from the perspective of regional organizations;

c) standardization, presented by ICAO and representative organizations of industry;

d) the perspective of users and customers of air navigation systems; and

e) presentations on infrastructure given by regional organizations.

1.2 SIGNAL PROVIDERS

1.2.1 Presentations by the signal providers and augmentation planners focussed primarily on the need for co-ordination and regional co-operation to ensure that systems were interoperable so that the goal of a seamless, global air traffic management (ATM) system could be attained. In this context, the need to address CNS/ATM in global terms was repeatedly stressed.

1.2.2 Latest developments and future implementation plans of the providers of the global positioning system (GPS) and the global orbiting navigation satellite system (GLONASS) were given. The conference noted that GNSS was a key feature of CNS/ATM systems and was expected to evolve to become a primary means of navigation, eventually replacing most conventional navigation systems. Furthermore, GNSS provided global coverage and was presently capable of supporting en-route navigation and non-precision approach needs and, in combination with local augmentation, would eventually meet all precision approach requirements. The conference noted that a number of institutional and legal matters needed to be resolved in order to achieve the anticipated benefits of GNSS and that these matters were currently being addressed within ICAO.

1.2.3 The conference was informed of work towards the development and use of GNSS receivers capable of receiving both GPS and GLONASS signals. Combining the signals of both systems would lead to full exploitation of GNSS for all phases of flight. Furthermore, the conference noted that action was being taken to re-establish the full GLONASS constellation of satellites as soon as possible.

1.2.4 The conference was provided with the latest progress information on the planning for air traffic services (ATS) routes linking Asia with Europe and with North America across Siberia and across the North Pole, respectively. These routes were expected to make use of both automatic dependent surveillance (ADS) and GNSS. Substantial savings in time and fuel were expected as such airspace becomes increasingly accessible.

1.2.5 The progress achieved and implementation schedules of the three augmentation systems being developed were also provided. In this context, the conference noted that the European global navigation overlay system (EGNOS) was to provide augmentation for both GPS and GLONASS. EGNOS was being implemented in two major steps: the advanced operational capability and final operational capability, leading to an augmentation service which would provide accuracy, integrity, availability and continuity, compliant with aviation requirements for sole means of navigation from en-route to Category I precision approach.

1.2.6 The conference was made aware of the commitment toward full implementation of the wide area augmentation system (WAAS) and that actions were under consideration to overcome possible difficulties such as signal interference. The conference noted the expected implementation date in the first half of 1999.

1.2.7 The conference was informed that multifunctional transport satellite (MTSAT), in addition to providing augmentation, would also allow improved communications through the use of controller-pilot data link communications and automatic dependent surveillance. This integration of systems would lead to true CNS/ATM systems capabilities and benefits, which include greater levels of safety associated with improved terrain clearance, as well as economic and environmental benefits.

1.2.8 All augmentation planners gave assurances that they would continue to work closely with and through ICAO to ensure seamlessness between their systems in an effort to provide a truly trans-national global system.

1.2.9 Finally, it was stressed that the technology was now available and what was needed for full implementation to proceed was a clear political and financial commitment.

1.3 POLICY MAKERS

1.3.1 Presentations by policy makers highlighted the progress being made by regional organizations toward implementation of CNS/ATM systems. The need for inter-regional as well as global co-operation was particularly stressed by the speakers. The need for joint participation of systems implementation was emphasized as being a cost-effective method for developing States to gain early and significant benefits. It was noted that close working relationships already existed between many of the regional planning groups concerning CNS/ATM technical, political, financial, and institutional planning and implementation matters. Regional representatives of developing States indicated that these States were eager to implement CNS/ATM systems as a means of improving safety levels.

1.3.2 The conference was reminded that the provision of air navigation services was increasingly becoming a privatized activity and that the need to agree on the principle and framework for the financing and global management of CNS/ATM systems was therefore necessary, as this would promote rapid implementation of CNS/ATM systems.

1.3.3 The conference recognized the particular problems experienced by some highly developed States which were mainly associated with congestion. It was noted that planning for implementation of CNS/ATM systems in such airspace required a full business case evaluation prior to making decisions.

1.3.4 The particular importance and necessity of political support to States from the regional organizations was underscored. It was noted that such support fostered a close co-ordination process between the technical and political sectors of the States.

1.4 STANDARDIZATION

1.4.1 Presentations on standardization highlighted the necessity for regional certification and regulatory authorities to work closely together. In the same context, the need to ensure compatibility between airborne and ground-based systems was stressed.

1.4.2 The conference was informed that, since the endorsement of the CNS/ATM systems concept, ICAO had made significant progress in the development of Standards and Recommended Practices (SARPs) in data link, the aeronautical telecommunications network (ATN) and aeronautical mobile satellite services (AMSS). It was further noted that a guiding principle in the development of SARPs for CNS/ATM systems had been toward improving safety, efficiency and regularity of flight operations, while also standardizing equipment carriage requirements.

1.4.3 The conference recalled that the strategic vision of CNS/ATM systems was to foster implementation of a seamless, global ATM system that would enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints and without compromising agreed target levels of safety. To attain this goal, it was noted that the vision, objectives and benefits of CNS/ATM systems had to be clearly established and the operational concept of a global ATM system had to be described in sufficient detail and clarity. Otherwise, different conceptions would continue to exist as to the benefits of the future system and how these benefits could be realized. A consensus on several issues therefore had to be reached to achieve the standardization necessary for future operation of ATM as a global service. These issues included, among others, autonomy of flight, separation assurance and situational awareness. In this regard, the conference noted that ICAO was progressing development of the conceptual work associated with CNS/ATM systems with the aim of ensuring that implementation of communications, navigation and surveillance (CNS) technologies is based on clearly established ATM operational requirements.

1.4.4 As a major point, the conference recalled that an emerging trend in aviation was a closer partnership between government and industry in the development of new systems, and that this co-operation, as well as increased co-operation among States, users and service providers, was essential for the implementation of CNS/ATM systems.

1.5 CUSTOMERS AND USERS

1.5.1 Presentations by the customers and users of the air navigation system stressed the need for speedy implementation of CNS/ATM systems, reminding the conference of the undesirable consequences of failing to take appropriate action. The need for a clear vision of the air navigation system that would emanate from implementation of CNS/ATM systems was emphasized, as this would clearly define the implementation path defining airspace infrastructure as well airborne equipment carriage requirements. It was noted that orderly and cost-effective implementation of CNS/ATM systems would ultimately benefit passengers and air freight shippers through satisfactory fares and rates.

1.5.2 The conference was reminded that the air transport industry had a good record of both innovation and safety. This industry had also been, and would continue to be, a prime architect of the global village that we were creating, and would continue to be an important part of economic growth. The need for co-operation between airlines, ICAO and States at the national and regional levels was emphasized. Such co-operation should result in expeditious implementation of CNS/ATM systems, leading to cost savings, improved safety, environmental benefits and enhanced capacity.

1.5.3 The important role that aviation played in the global economy was highlighted, noting that further economic expansion was inextricably tied to a prosperous air transport industry, which itself was reliant on an efficient air traffic management system. Furthermore, the conference recalled that air transport was essential to business and tourism, both of which use air transport for the vast majority of travel and the transport of goods. The job growth potential associated with this mode of transport went far beyond the air transport and tourism industries. Based on this, an efficient air traffic management system was considered to be critical to the successful development of business and to the overall health of the global economy.

1.6 INFRASTRUCTURE AND FINANCING

1.6.1 Presentations on infrastructure and financing, given by regional organizations, emphasized the need for both inter- and intra-regional harmonization. The conference was reminded that CNS/ATM systems were capable of serving a large number of States, even regions of the world, and also required major investments. In this context, financing of these systems would increasingly take on a multi-national dimension. It was therefore noted that States and regions would need to co-operate with each other both politically and economically to attain the benefits from the efficiency that CNS/ATM systems offer. Furthermore, it was noted that strategies for implementation of CNS/ATM systems were required at the political as well as at the technical level in order to ensure that appropriate policy statements would be developed which would facilitate implementation of CNS/ATM systems.

1.6.2 Over the course of the presentations, it was noted that economics and air transport were closely associated and that economic creativity was necessary to ensure that financial resources were made available to the aviation industry. This could include financing through user charges as well as other financing arrangements. The conference was asked to pay special attention to the needs of developing States in this regard. The importance of including human resource development as an integral part of budgetary planning associated with CNS/ATM systems was also emphasized.

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Agenda Item 2: Institutional issues

The conference, under this agenda item, considered the organizational formats at the national and multinational levels, the options available for co-operative approaches, and a planning methodology for implementation of CNS/ATM systems. The presentation of action papers was structured in accordance with the agenda, which contained organizational structures at the national level, co-operative and sub-regional approaches, and the management of a global ATM system, including considerations related to ICAO's global plan for CNS/ATM systems.

2.1 ORGANIZATIONAL STRUCTURES AT THE NATIONAL LEVEL

2.1.1 The conference recognized that the organizational structure under which CNS/ATM systems and air navigation services operated was fundamental to their financial viability. With the growing demand placed on financial self-sufficiency, States around the world have been reviewing these organizational structures, which has led to increased financial and operational autonomy at the national level and increased international co-operation.

2.1.2 The conference was apprised of the special economic and financial circumstances of the Africa–Indian Ocean (AFI) Region concerning the implementation of CNS/ATM systems, and invited Contracting States to consider the creation of autonomous civil aviation entities and to ensure that they have sound financial management, as well as that their income is dedicated to the aviation sector.

2.2 CO-OPERATIVE AND SUB-REGIONAL APPROACHES

2.2.1 The conference noted that, due to their global coverage, most of the CNS/ATM systems components have an impact on implementation options which, in turn, would call for institutional arrangements which may be somewhat different from those for the current air navigation systems. The conference was invited to adopt a co-operative, multinational approach to implementing regional and global elements of CNS/ATM systems.

2.2.2 An initiative to establish an inter-regional, multi-mission satellite system dedicated to CNS/ATM systems serving Africa and the Middle East was presented to the conference. The conference was invited to urge the States of those regions concerned to assess the benefits of utilizing the proposed system. It was pointed out that the proposal required detailed examination, particularly regarding how it fit into ICAO's regional planning process.

2.2.3 The European experience in the development and implementation of CNS/ATM systems as part of the global CNS/ATM system was shared in the conference. It described the established mechanism and actions currently undertaken to meet users' requirements, paying particular attention to the institutional and financial conditions prevailing in Europe. The conference was invited to recognize the importance of regional solutions within the global ICAO CNS/ATM concept for the development and implementation of CNS/ATM systems, including the required legal, institutional and financial framework and the need for the involvement of all partners in a collaborative decision-making process in the development of CNS/ATM plans on a regional/global basis. The conference endorsed the central role of ICAO in the implementation of a long-term global GNSS system by developing technical and operational SARPs, and in monitoring and co-ordinating the developments of GNSS-related projects at regional levels.

2.2.4 The current air navigation systems gave States not only the responsibility for the operational conditions of the systems, but also control, operation and ownership of the systems. The air navigation systems of the future, which would be largely global in nature, would maintain this responsibility on the part of States; however, control, operation and ownership of the systems could be treated differently. The conference discussed this situation and called upon ICAO to continue the studies aimed at creating favourable conditions for guaranteeing joint and individual responsibility by States in the planning and implementation of the future CNS/ATM systems, ensuring an appropriate level of control, operation and ownership on the part of each State.

2.2.5 The conference noted the co-operative approach adopted by the States of the South Pacific Forum to manage the Pacific airspace of the Forum region as a unified airspace consistent with the ICAO approach to homogenous ATM areas. As a result, it paved the way for an early transition to CNS/ATM systems as a means of enhancing safe and cost-effective management of air traffic operating within and across the Pacific Region. The conference was invited to encourage other States to consider a similar co-operative approach to the management of homogenous ATM areas.

2.2.6 The conference noted the activities carried out in Africa within the framework of the transition to CNS/ATM systems. Emphasis was placed on the need to promote and support the existing and future regional bodies, as well as on co-ordination and co-operation. The conference expressed a strong need for financial institutions to consider financing of CNS/ATM systems for the benefit of States. It was also suggested that ICAO assist and co-ordinate the establishment of multinational charges collection agencies upon request by relevant Contracting States.

2.3 THE MANAGEMENT OF GLOBAL ATM SYSTEMS, INCLUDING CONSIDERATIONS RELATED TO ICAO'S GLOBAL PLAN FOR CNS/ATM SYSTEMS

2.3.1 It was noted that, in order to achieve an integrated global air traffic management system, it was necessary to adopt a co-operative approach to the planning, establishment and management of the CNS/ATM systems infrastructure on the basis of homogeneous ATM areas and major international traffic flows. The agreement of the States concerned was a prerequisite for adopting the approach to implementation of CNS/ATM systems on the basis of homogeneous ATM areas.

2.3.2 The concept of an "air navigation system" was introduced. ICAO was invited to study this concept and the hierarchical structure of air navigation support for the purpose of the gradual transition from unco-ordinated sub-systems to a single, integrated air navigation system.

2.3.3 It was highlighted that ICAO has a role to play in the timely implementation of the new CNS/ATM systems through a dedicated mechanism that would be able to assist States in all aspects of this process.

2.3.4 The concept of the target level of safety (TLS) was introduced. The conference considered the specific features of using the TLS at the levels of national and regional planning for the implementation of CNS/ATM systems. ICAO was requested to entrust the appropriate panel to study this issue.

2.4 PANEL DISCUSSIONS

2.4.1 Commercialization of air navigation services

2.4.1.1 The first panel reviewed the current practices in one country — in this case, Canada — related to the commercialization of air navigation services, the financing of the newly created private organization, and the management of safety oversight in the new environment.

2.4.1.2 The conference was given a snapshot of NAV CANADA pertaining to its establishment as a private company. The basic objective of its creation was to bring about management efficiency and meet investment demands. Regarding the financial aspects of NAV CANADA, the conference was informed that it was able to raise the required capital without any support from the government. A regulatory perspective highlighted that performance-based regulations were applied and that safety oversight was assured by working in partnership with NAV CANADA and by enforcing regulatory action when alternatives failed to achieve results.

2.4.2 Current trends at the regional and sub-regional levels

2.4.2.1 The planning efforts in the European Region, which has a multitude of arrangements for the provision of air navigation services, were presented during the second panel discussion of the conference. The need for the involvement of all partners in a collaborative decision-making process in the development of CNS/ATM systems plans on a regional/global basis was highlighted. It was noted that the key feature of corporatisation was the separation of air navigation services provision from the government. Its main advantage had been the improved access to capital to invest in systems to cope with the ever-increasing volume of air traffic.

2.5 CONCLUSIONS

2.5.1 On the basis of the documentation before it and the subsequent discussion, the conference arrived at the following conclusions:

Conclusion 2/1 – Autonomous entities

In some States, increased efficiencies and financial transparency with potential economic benefits may result at the national level from assigning the operation of air navigation services to autonomous entities. However, there is a need to accommodate differing situations in different regions and take into account different political and cultural scenarios. States remain ultimately responsible for ensuring safety. The autonomous entity may not be a viable solution for a State having low traffic density.

Conclusion 2/2 – Ability to secure and repay loans

Servicing of loans to finance CNS/ATM systems components is greatly facilitated at the national level by the existence of autonomous authorities operating air navigation services, and also at the national and/or international level by co-operative arrangements through user charges and other modes of funding.

Conclusion 2/3 – Involvement of partners

There is a need for the involvement of all partners in a collaborative decision-making process in the development of CNS/ATM plans on a regional/global basis.

2.6 RECOMMENDATIONS

2.6.1 The conference consequently adopted the following recommendations:

Recommendation 2/4 – Facilitating access to money markets

That States or group of States may consider the possibility of establishing autonomous entities to operate their air navigation services where appropriate to the circumstances, and particularly where traffic density would permit the generation of user charges to make such entities self-sustaining.

Recommendation 2/5 – Co-operative ventures

That States :

a) consider establishment of joint charges collection agencies whenever this would increase efficiency in charges collection; and

b) consider, where appropriate, development and/or participation in sub-regional, regional or global co-operative ventures to provide CNS/ATM systems components such as delegation of services, sharing of data, common training institutions, co-operative research and development projects.

Recommendation 2/6 – ICAO's assistance in co-operative schemes

That ICAO:

a) make better known the expertise it possesses and offer neutral advice and services with regard to the administration of international co-operative cost-recovery schemes for CNS/ATM systems components in particular and air navigation services in general; and

b) in co-ordination with Contracting States and other multilateral organizations, assist States in developing efficient billing and collection systems.

Recommendation 2/7 – Establishment and management of CNS/ATM systems at the national, regional and global levels

That States and groups of States adopt a co-operative, multinational approach in order to ensure seamless and interoperable systems at the regional and global levels with emphasis on co-ordination with adjacent areas and, by doing so, avoid proliferation of system elements in order to reduce costs, enhance safety and increase operational efficiency.

Recommendation 2/8 – Need for political commitment for implementation of CNS/ATM systems

That ICAO, in co-ordination with States and regional and sub-regional organizations, make arrangements to generate the necessary political will at the highest level possible needed to sustain the implementation of CNS/ATM systems.

Recommendation 2/9 – Encouragement to financial institutions

That financial institutions and developed States be encouraged to extend concessionary funding for the CNS/ATM systems, at least at the initial stages of implementation in the developing States. Such funding could be made available through bilateral programmes and development banks.

Recommendation 2/10 – Identification of homogeneous ATM areas and major international traffic flows at the global, regional and sub-regional levels

That ICAO's regional planning groups identify homogeneous ATM areas and major international traffic flows at the global, regional and sub-regional levels, with the support of CNS/ATM implementation partners, to ensure the co-ordinated implementation of CNS/ATM systems resulting in a seamless environment for airspace users.

Recommendation 2/11 – Planning and implementation of CNS/ATM systems by service providers and airspace users

That service providers and airspace users, at the global and regional levels, participate in the planning and implementation of CNS/ATM systems on the basis of homogeneous ATM areas and major international traffic flows.

Recommendation 2/12 – The need to adopt planning methodologies that are cost-beneficial

That States adopt new planning methodologies that will ensure cost-beneficial air navigation services by planning airspace structures on the basis of operational requirements, the resulting technical requirements and cost effectiveness.

Recommendation 2/13 – Regional and sub-regional co-ordination functions

That regional and sub-regional organizations should consider the establishment of a mechanism to undertake assignments covering a wide spectrum of functions aiming at co-ordinated implementation of CNS/ATM systems. (See Recommendation 2/15)

Recommendation 2/14 – Further studies of the TLS concept

That ICAO be invited to entrust to the appropriate panel the study of the concept of using the target level of safety (TLS) of air traffic at the national and regional levels.

Recommendation 2/15 – ICAO's central role

That States endorse the central role of ICAO towards the implementation of long-term GNSS by developing technical and operational Standards and Recommended Practices and recognize as a long-term goal the promotion, development and operation of an international civil GNSS.

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Agenda Item 3: Financial matters

3.1 INTRODUCTION

3.1.1 The objective of this agenda item, which was the primary focus of the conference, was to convince the providers of air navigation services and financial institutions that implementation of CNS/ATM systems would generate a significant positive return on investment, an investment which could be recovered through user charges.

3.1.2 On the economic assessment of CNS/ATM systems, the Secretariat in their presentation demonstrated that the implementation of CNS/ATM systems would contribute substantially to alleviating airspace congestion and improve the overall efficiency of the air traffic management system, with a consequential impact on the growth of civil aviation and its contribution to the economy at large. It was emphasized that the implementation of CNS/ATM systems would generate a significant positive return on investment. Supporting information was provided to the conference on the economic impact of civil aviation, cost and benefits for providers and users, and comparison of implementation options. The conference also had available ICAO Circular 257, *Economics of Satellite-based Air Navigation Services* (Guidelines for cost-benefit analysis of CNS/ATM).

3.1.3 On cost recovery and financing of CNS/ATM systems, the Secretariat, having noted that the costs to air navigation services providers of investing in CNS/ATM systems implementation could be recovered through user charges, addressed sources of financing of facilities and services, modalities of payment, cost recovery policy, cost recovery and financing mechanisms, loan guarantees and application of sound financial control and management. Supporting information was provided on the international cost recovery policy, basic aspects of financial control and management and sources of funds and financing mechanisms.

3.1.4 The Secretariat put forward a number of basic conclusions and recommendations for adoption by the conference.

3.1.5 European States, Members of the European Civil Aviation Conference (ECAC), highlighted the key economic and financial issues involved in implementing CNS/ATM systems from a European perspective, and invited the conference to recognize that a full and detailed business case was required for all CNS/ATM projects, and to endorse the need to address as a matter of urgency the issue of cost allocation amongst all users of GNSS. The European Commission described the situation in Europe as a unique example of a co-operative approach for implementation of CNS/ATM systems.

3.1.6 African States underscored the benefits that the Africa-Indian Ocean Region could derive from the implementation of the CNS/ATM systems, outlined the AFI CNS/ATM Implementation Plan and recommended that the conference urge financial institutions to consider favourably financing the timely implementation of CNS/ATM systems. They also outlined the special economic and financial circumstances of the AFI Region in the context of implementation of the CNS/ATM systems, and recommended concessionary funding for at least the initial phases of CNS/ATM systems implementation in developing States, as well as the establishment of autonomous civil aviation entities. The African States also proposed that ICAO expedite studies on a proposal for an international aeronautical fund, identify where CNS/ATM systems implementation could not be carried out on a self-financing basis and provide the required

assistance, and assist States in developing efficient billing and collection systems. Two other States also provided arguments for ICAO to proceed with the development of an international aeronautical fund.

3.1.7 One State referred to the solution the implementation of CNS/ATM systems offers to various air navigation problems, and invited the conference to recommend that means be devised to urge developed States, donors and United Nations agencies to provide financial assistance and expertise to implement CNS/ATM systems as soon as possible.

3.1.8 Another State emphasized the importance of using cost-benefit analyses and technical audit processes in the development of business cases to enhance the end result of any State or regional programme to implement CNS/ATM systems.

3.1.9 The International Air Transport Association reiterated concerns, from economic and financial points of view, that commercial air carriers have regarding the transition to the CNS/ATM systems and requested that States make individual commitments to the decommissioning of existing equipment in order to facilitate financing and the timely and proper equipment of aircraft.

3.1.10 Finally, one State provided information on CNS/ATM trials and implementation for its territory, and another State explored the "business case" approach taken in planning the introduction of CNS/ATM for its territory. Another region provided information on costs and benefits for providers and users in the implementation of CNS/ATM systems.

3.2 BUSINESS CASES AND FINANCIAL INSTITUTIONS

3.2.1 Following the introduction of the various working papers and discussions thereof, the conference was presented with some examples of "business cases" developed to justify the financing for the transition to CNS/ATM systems. A "business case" is a study that includes the analyses of both costs and benefits of CNS/ATM systems implementation options and the requirements for a financing scheme including revenues, expenses and pay back periods. Based on the implementation strategy, business cases were expected to be conducted at the level of national, sub-regional, regional and homogeneous ATM areas, as required.

3.2.2 The presentation made by the Secretariat described how a business case could be developed for establishing future CNS systems, using as an example the six flight information regions (FIRs) managed by the Agence pour la Sécurité de la navigation aérienne en Afrique et à Madagascar (ASECNA), comprising 16 Member States. The presentation included some comments on using material gathered from a cost-benefit analysis to build a business case and discussed issues the financing institutions might look for in deciding whether or not to fund a project. Also covered were ground rules, assumptions and methodology to estimate the revenues and expenses to both the service provider (e.g. ASECNA) and the airline users.

3.2.3 The presentation made by Australia looked at CNS/ATM systems from a cost-benefit perspective and, in particular, at the way in which business cases have been dealt with by Australia in selecting those components which will deliver operational enhancements and economic benefits to aviation customers. The presentation emphasized the importance of business cases and the need for a co-operative partnership with all shareholders, and outlined a generic methodology. The presentation concluded with the concept of a "multi-modal business case" for CNS which needed to be progressed for the future.

3.2.4 The presentation made by a "CNS/ATM focussed team," a group of airlines, airframe manufacturers and air traffic control (ATC) service providers, described the work being done in the development of a global transition plan based on economic analyses. The presentation emphasized the lack

of a strategic economically based transition plan, and the importance of a sound business plan to assist in the implementation of CNS/ATM systems.

3.2.5 One financial institution made a presentation describing its lending methods based on sound financing principles, transparency and the ability of States to pay back the financial obligations based on sound business plans. Another financial institution presented a generic model for the financing and implementation of CNS/ATM systems.

3.2.6 An examination of the requirements of the implementation of CNS/ATM systems and the implications for the providers and the users were discussed. One institution proceeded to outline a concept to implement a system for regional air traffic management. The concept envisaged that facility implementation would be achieved on a fully transparent basis, according to specifications agreed by a region or sub-regions. Private capital and bank capital would be used to finance the cost of investment.

3.2.7 The presentation summarized the respective roles envisaged for the public and private sectors and of the risks and rewards to them of the working partnership envisaged by such a concept.

3.2.8 A presentation made by IATA emphasized that the air navigation providers were guaranteed to get back from the civil air transport operators all of the money spent on providing the worldwide air navigation system.

3.2.9 A presentation by the International Mobile Satellite Organization (Inmarsat) noted that States can avoid capital investment in satellites and satellite support infrastructure for CNS/ATM systems by using the facilities already implemented by Inmarsat. These encompass ICAO SARPs — compliant services enabling voice and data communications between controllers and pilots and the satellite-based augmentation of the GPS and GLONASS satellite navigation services.

3.3 CONCLUDING DISCUSSIONS

3.3.1 The conference noted that the issue of financing was of paramount importance to the successful implementation of ICAO CNS/ATM systems. It recognized that the amounts of investment required are regionally dependent and could call for innovative as well as traditional approaches to financing, including the exploring of new sources and financial mechanisms.

3.3.2 Extensive discussions were held on the subject of the creation of an international development fund, a proposal made by 53 African States and two other States. Many States spoke in favour of this proposal, recognizing that substantial investment, and additional sources of funding, would be required for the implementation. The proposed fund would provide the necessary arrangements presently lacking for such a system of international inspection, audit and follow-up as might lead to improved operations by various autonomous civil aviation authorities and agencies. The fund would also help efforts for promoting safety by the removal of shortcomings and deficiencies worldwide, as well as ensuring timely implementation of the global CNS/ATM system.

3.3.3 Some States expressed concern that such a fund would be at variance with established ICAO principles on charges related to the provision of air navigation services; that the time required to set it up could effectively delay implementation of the CNS/ATM systems. Views were also expressed that the fund might be initiated at a State or regional level, depending on the local requirements. Opinions were also raised that new funding mechanisms should only be created if existing ones could not be readily adapted.

3.3.4 Financing requirements relating to the implementation of CNS/ATM systems technology could vary from State to State and the regions concerned. For the timely implementation, ICAO had developed methodologies to assist States in conducting their own cost-benefit analysis and the formulation of sound business cases.

3.3.5 In order to secure assistance in the States where this was required, several issues were to be examined, namely: which States were unable to proceed with the implementation due to the lack of funding; what kind of technology was essential in this identified area in order to provide safe air navigation services; what were the financial requirements and how assistance could be offered.

3.3.6 The requirement for further analysis of the proposed international aeronautical development fund was advocated, noting that the ICAO Council had already taken steps called for by the 31st Session of the Assembly. In this connection, additional resources necessary to carry out this study were called for in order to expedite its urgent completion.

3.3.7 The concept of the creation of autonomous authorities in itself may not have fully satisfied the financial requirements in certain areas of low traffic density. The importance of the selection of the right technologies and equipment based on the requirements of the region as envisaged by the regional plan, in particular concerning safety, needed to be established. Emphasis also was placed on the regional co-operation required to achieve the economic viability of implementation programmes, taking into account the concept of homogenous ATM areas and major traffic flows as identified by the ICAO planning and implementation regional groups.

3.4 CONCLUSIONS

3.4.1 On the basis of the documentation before it and the subsequent discussion, the conference arrived at the following conclusions:

Conclusion 3/1 – Contribution of civil aviation

Civil aviation is highly beneficial for the economies of States.

Conclusion 3/2 – Contribution of air traffic management

An efficient ATM structure is a foundation for the economic provision of air transport services.

Conclusion 3/3 – Cost-benefit of CNS/ATM

CNS/ATM is highly cost-beneficial for users and hence, while frequently not cost-beneficial for providers, is cost-beneficial for providers and users combined.

Conclusion 3/4 – Cost recovery of CNS/ATM systems

Costs incurred by States and other providers in implementing and operating CNS/ATM systems components can be included in the cost basis of, and recovered through, air navigation services charges or other user charges levied on air traffic.

Conclusion 3/5 – CNS/ATM financing dimension

The financing of CNS/ATM systems components should reflect both the multinational dimension of most of the components and the fact that they are air navigation services.

Conclusion 3/6 – Sound financial management

The demonstration of sound financial management, including the provision of detailed cost and revenue data as well as the preparation of sound financing plans and detailed business cases, is critical to securing financing for CNS/ATM systems components and air navigation services in general.

Conclusion 3/7 – Cost of ICAO assistance

The cost of ICAO assistance in cost recovery, financing and other aspects of financial management of CNS/ATM systems components and other aspects of air navigation services, including the preparation for and negotiation of loans to finance air navigation services infrastructure, may be recovered, *inter alia*, through air navigation services charges.

3.5 RECOMMENDATIONS

3.5.1 The conference consequently adopted the following recommendations:

Recommendation 3/8 – Financial management

That States:

a) recognize the necessity of properly identifying costs and revenues, and of developing financing plans, in the cost recovery and financing of air navigation services; and

b) ensure the exercise of financial control and management, including the maintenance of accounting systems required to that effect.

Recommendation 3/9 – Cost-benefit and business cases

That States:

a) carry out cost-benefit studies on the implementation of CNS/ATM systems, taking into account the available guidance from ICAO and the advantages of the Net Present Value methodology; and

b) develop full and detailed business cases at national and sub-regional or regional levels as required, taking into account the concept of homogeneous air traffic management areas and major international traffic flows identified by the ICAO planning and implementation regional groups with the assistance of ICAO, as necessary.

Recommendation 3/10 – Cost recovery

That the costs of implementing and operating CNS/ATM systems components be recovered through the medium of user charges.

Recommendation 3/11 – Use of revenues from user charges

That States ensure that revenues from airport and air navigation services charges are applied solely towards defraying the costs of these facilities and services in accordance with the established rules and procedures.

Recommendation 3/12 – Priority in financing

That States to the extent possible ensure that in the financing of air navigation services, including CNS/ATM systems components, priority is always given to facilities and services provided for under the ICAO Regional Air Navigation Plan(s).

Recommendation 3/13 – Loan guarantees

That States, where the provision of a CNS/ATM systems component requires debt financing, guarantee the servicing and repayment of the loan whenever this is appropriate.

Recommendation 3/14 – Concessionary funding and the provision of expertise

That States and ICAO:

a) identify those areas in less developed regions where the implementation of CNS/ATM systems cannot be carried out on a self-financing basis;

b) encourage regional co-operation among service providers to achieve efficient implementation and economic viability where necessary; and

c) seek for these areas concessionary funding and the provision of expertise for the transition to CNS/ATM systems, *inter alia*, through the ICAO Technical Co-operation mechanism, voluntary donations, bilateral and multilateral co-operation programmes, international organizations and development banks.

Recommendation 3/15 – Role of financing institutions

That States should encourage financing institutions to provide funds for the implementation of CNS/ATM systems components, when provided with clear indications of their economic viability.

Recommendation 3/16 – ICAO follow-up action

That ICAO:

a) address, as a matter of urgency, the issue of cost allocation amongst all users of GNSS;

b) continue to promote awareness of and provide guidance on the economic benefits of civil aviation for the economies of States and of CNS/ATM systems for civil aviation;

c) further develop the circular providing guidelines for national planning for CNS/ATM systems to include more specific cost-benefit and technical audit processes, including guidelines for the development of sound business cases;

d) assist States in CNS/ATM systems implementation through the application of guidance on cost-benefit and business cases, including the development of model cases for homogeneous air traffic management areas and major international traffic flows;

e) assist States, on request and on a cost recovery basis, in their preparation and negotiation of loans to finance CNS/ATM systems components and other air navigation services infrastructure; and

f) expedite the studies of the proposal on the establishment of the International Aeronautical Fund presented to the 31st Session of the Assembly. Adequate amounts should be allocated for the completion of the studies.

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Agenda Item 4: Technical co-operation challenges

4.1 INTRODUCTION

4.1.1 The conference was advised that, for worldwide CNS/ATM systems implementation to proceed early and in a harmonious fashion, thus delivering maximum safety, economic and environmental benefits to States, users and service providers, technical co-operation needed to be made available to States requiring assistance. Providing for regional and inter-regional seamless and interoperable air navigation services worldwide, presented a major challenge to the civil aviation community and would require unprecedented co-operative efforts on the part of States, providers of technical assistance in civil aviation. Only full co-operation among all partners would ensure co-ordinated and timely CNS/ATM systems implementation.

4.1.2 Financing would have to be sought in order to assist States in obtaining CNS/ATM systems related technical co-operation. This would ensure that safety and technical considerations will always prevail, in the interest of States, users and service providers alike.

4.2 STATES' ASSISTANCE REQUIREMENTS

4.2.1 The conference was also presented with an overview of surveys carried out by ICAO wherein States reported their requirements for assistance with CNS/ATM systems implementation. The conference noted the results of the surveys which demonstrated that a significant majority of countries required assistance across the whole spectrum of CNS/ATM planning and implementation, from operational needs identification through systems specification, detailed planning, cost-benefit and cost recovery analyses to equipment procurement and training of personnel. Also, ICAO surveys indicated the desire of States for assistance from ICAO with funds mobilization as well as for ICAO's involvement with the execution and quality assurance of CNS/ATM related projects.

4.3 TECHNICAL CO-OPERATION PROJECTS

4.3.1 Representatives of States and groups of States introduced to the conference progress in national CNS/ATM systems planning and implementation, their respective CNS/ATM related capabilities as well as their views on ICAO's role. Requirements for transition planning and full integration of traditional technologies with satellite-based technology were emphasized as was the need for trials and experiments.

4.3.2 Also, the need for guaranteed GNSS systems performance, for resolving associated liability and system development and control issues were acknowledged. In this respect, inter-regional co-ordination was seen as essential to achieve harmonization and global benefits. The setting up of an advisory group of civil aviation administrations for development of guidelines for certification, approval and continued operational safety of a global CNS/ATM system was proposed.

4.3.3 Several States reported on their experience with providing technical co-operation to other States or groups of States in CNS/ATM systems implementation and on the progress of system trials and experiments.

4.3.4 Presentations provided by several States were received on experiences with technical co-operation from ICAO. The conference noted ICAO's capabilities in providing technical co-operation in

planning and implementation of CNS/ATM systems and its experience with the execution of related projects in various regions and countries, underlining the need for continued high quality project monitoring and provision of expertise, including project follow-up.

4.3.5 Explanations were provided of the availability, through ICAO's Technical Co-operation Programme, of CNS/ATM specific project expertise and training arrangements. ICAO's experience with the provision of related equipment purchases was noted. CNS/ATM sub-regional co-operative aspects were presented and the advantages of a regional approach retained.

4.4 FINANCING OF DEVELOPMENT ASSISTANCE

4.4.1 The conference was presented with a brief overview of the mandate, objectives and major programmes of the ICAO Objectives Implementation Mechanism, established by the 31st Session of the ICAO Assembly to advance the implementation of SARPs, air navigation plans, civil aviation master plans, safety oversight and of CNS/ATM systems planning and implementation. The guarantee of SARPs compliance as well as the neutrality, objectivity and cost-effectiveness of the mechanism were presented. The support of this mechanism by the CNS/ATM Systems Implementation Task Force (CASITAF) and ALLPIRG/Advisory Group was noted.

4.4.2 Certain advantages to States and financing institutions in associating ICAO, through this mechanism, with CNS/ATM planning and implementation projects were briefly explained. Encouragement of States and financing institutions for the utilization of this mechanism for CNS/ATM technical co-operation was noted with the proviso that duplication of other efforts be avoided and that the regional planning implementation process and the ICAO Regional Offices be fully integrated.

4.5 CONCLUSION

4.5.1 On the basis of the documentation before it and the subsequent discussion, the conference arrived at the following conclusion:

Conclusion 4/1 – Technical co-operation challenges

The World-wide CNS/ATM Systems Implementation Conference acknowledges and supports the vital interest of States requiring assistance in ICAO's execution and quality assurance of CNS/ATM technical co-operation projects.

4.6 RECOMMENDATION

4.6.1 On the basis of the documentation before it and the subsequent discussion, the conference formulated the following recommendation:

Recommendation 4/2 – Role of technical co-operation in CNS/ATM planning and implementation

That:

a) developed States and other donors should assist States experiencing difficulties in obtaining funding for CNS/ATM planning and implementation to achieve a global and seamless ATM environment;

b) ICAO should continue and even enhance its important co-ordinating role of technical co-operation in CNS/ATM planning and implementation, in close consultation with all partners and taking into account the regional approach; and

c) all parties concerned should strengthen co-operation in the design, development and operation of GNSS, paying particular attention to the continued performance of the positioning signals.

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Agenda Item 5: Legal aspects

5.1 **LEGAL ISSUES OF GNSS**

5.1.1 The results of the work of the Panel of Legal Experts on the Establishment of a Legal Framework with regard to GNSS (LTEP), established by the ICAO Council in 1995, were presented to the conference. These results comprised, firstly, a draft Charter on the Rights and Obligations of States Relating to GNSS Services, which embodied certain fundamental principles applicable to the implementation and operation of GNSS, including safety of international civil aviation, universal accessibility of GNSS services without discrimination, preservation of States sovereign rights, and continuity of GNSS services. The LTEP also put forward recommendations on the legal aspects related to certification, liability, administration, financing and cost recovery, as well as future operating structures of GNSS. These recommendations, together with the draft Charter, had been the subject of a report of the LTEP to the Council at its 152nd and 153rd Sessions.

5.1.2 The conference noted that, in accordance with the decision of the Council, the work of the LTEP would be further considered by the 32nd Session of the Assembly. The conference therefore focussed on the future directions of legal work related to CNS/ATM systems.

5.1.3 With the presentations made by a three-member panel, the conference extensively discussed legal issues of GNSS. A widely held view was that CNS/ATM represented a quantum leap in relation to existing systems and presented therefore a new situation. Furthermore, the key elements of GNSS were under the control of certain individual States. For this reason, it would be necessary to have an appropriate legal framework at a worldwide level to govern the operation and availability of GNSS. It was believed that such a framework would provide firm guarantees from the outset, as regards universal accessibility, continuity, accuracy, reliability and integrity, that it would cover the issues of liability, and that it would allow for full participation of all interested parties in the operation and control of GNSS.

5.1.4 On the other hand, an alternative view was expressed that the existing legal framework, namely the Chicago Convention, was sufficient to govern GNSS which did not present any difference, from a legal point of view, from traditional navigation aids. While CNS/ATM systems were revolutionizing global air navigation, they need not revolutionize international aviation law. GNSS was not qualitatively different in its institutional and legal aspects from other long-range navigation aids. The existing legal framework, including the Chicago Convention, was sufficient for GNSS. The marketplace would ultimately determine when GNSS would be accepted and the degree to which it was relied upon.

5.1.5 The conference discussed at length the question of whether or not a binding international convention for long-term GNSS was required. A very widely supported view was expressed that only an international convention could instill the necessary confidence and provide the necessary guarantees. It was observed that States would be reluctant to implement the system on the presumption that they use the system on their own merit and at their own risk. Therefore, the draft Charter should be adopted in the form of an Assembly Resolution only as an interim solution. Meanwhile, work towards an international binding instrument would proceed.

5.1.6 Another view was expressed that a pragmatic solution should be adopted and that there was already a legal framework in place which included the Chicago Convention, customary law and the draft Charter. The Charter, if adopted by the Assembly, could constitute obligatory norms of international law,

as evidenced by some resolutions adopted in the past. Furthermore, the exchange of letters between ICAO and the existing provider States as well as international Standards and Recommended Practices to be adopted by ICAO could provide additional confidence. It would be more practical to wait for the future development of the technology before deciding what should be done.

5.1.7 Other views were expressed that, while an international convention would be desirable for the long-term future, an interim approach may take the form of regional arrangements and a chain of contracts among primary signal providers, augmentation services providers and users as outlined during the LTEP discussions.

5.1.8 The predominant view was that the adoption of the Charter was only one step in the long-term legal framework, which should take the form of an international convention. Meanwhile, the implementation of CNS/ATM systems should not be delayed pending work on the legal issues relating to this matter. A number of States at the conference opposed, however, the reference to an international convention in Conclusion 5/1.

5.1.9 With respect to the question of liability, views of some States were expressed indicating that the introduction of GNSS did not change the existing liability system. Furthermore, the use of GNSS signals had enabled some providers to reduce the insurance premium. It was therefore advocated that there was no need to address the question of liability. The predominant view, however, was that there was a need to address the question of liability within the long-term legal framework.

5.1.10 A further view expressed was that consideration of the legal framework should not be limited to GNSS only, but that it should be extended also to the other aspects of CNS/ATM systems. For the protection of the safety of civil aviation, legal measures should be developed to deal effectively with potential unlawful interference with the processing and flow of data relating to CNS/ATM systems.

5.2 CONCLUSIONS

5.2.1 On the basis of the documentation before it and the subsequent discussion, the conference arrived at the following conclusions:

Conclusion 5/1 – CNS/ATM legal framework

The complex legal aspects of the implementation of CNS/ATM systems, including GNSS, require further work. Such further work should not, however, delay implementation of CNS/ATM systems, since there is nothing inherent in the CNS/ATM system which is inconsistent with the Chicago Convention. The adoption of the Charter should therefore be regarded only as an interim framework for the short term, while further consideration is given to the long term legal framework, including consideration of the development of a draft international convention for this purpose.

Conclusion 5/2 – Regional arrangements

Regional arrangements may contribute to the development of a global legal and institutional framework with regard to long-term GNSS, provided they are compatible with the global framework to the extent that it exists, and they support the interoperability of regional CNS/ATM components. The conference endorsed the central role of ICAO towards the implementation of a long-term global GNSS system by developing technical and operational SARPs.

5.3 RECOMMENDATIONS

5.3.1 Upon further discussion, the conference agreed on the following recommendations:

Recommendation 5/3 – Further work on CNS/ATM legal aspects

The complex legal aspects of the implementation of CNS/ATM systems, including GNSS, require further work by ICAO. Such further work should seek to elaborate an appropriate long-term legal framework to govern the operation and availability of CNS/ATM, including the consideration of an international convention for this purpose. Such further work should not, however, delay implementation of CNS/ATM systems.

Recommendation 5/4 – Objectives of further work (on CNS/ATM legal aspects)

Further work on this matter, which should be carried out by ICAO, should have the following objectives:

a) to develop and build mutual confidence among States regarding CNS/ATM systems; and

b) to support the implementation of CNS/ATM systems.

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Agenda Item 6: Training needs

6.1 INTRODUCTION

6.1.1 Under this agenda item, the conference reviewed the human factors and training issues associated with CNS/ATM systems.

6.1.2 The high level of automation and interdependency of the CNS/ATM system has been raising several human factors issues. In addition, the task of designing and implementing training for ICAO CNS/ATM systems that utilize higher levels of automation, presents additional challenges. Lessons learned concerning these two areas indicate that they should be considered as an integral part of any plan to implement the new technologies.

6.1.3 A major goal of CNS/ATM systems remains to create a seamless air navigation system. A seamless air navigation environment would require an international team that is repared to perform its job in such an environment. The new CNS/ATM systems are also based on many new concepts, and this change presents a greater challenge to trainers.

6.2 HUMAN FACTORS ISSUES

6.2.1 The conference noted that CNS/ATM systems are technology-intensive, and their safest and most efficient performance is predicated upon the correct utilization of technology, as intended by its designers. There is considerable experience within the aviation industry regarding the introduction of new technology, and such experience should guide CNS/ATM endeavours. In particular, the experience obtained – often at considerable expense – during the introduction of advanced-technology flight deck aircraft is of special relevance and application to further CNS/ATM systems.

6.2.2 The most important human factors issue in regards to human-machine interface is the ability of the human operator to maintain *situational awareness*. A by-product of degraded situational awareness is *mode error*. Mode error was defined as a joint human-machine system breakdown in which a human loses track of the current machine configuration, and a machine interprets the human's input differently from that intended. The conference noted that if the "joint human-machine system" is duly considered, mode errors can be pro-actively anticipated and eliminated during design.

6.2.3 Human-technology interface design issues can be addressed during the design stage of the system, or after system implementation in the operational context. The decision of which alternative to pursue has significant financial implications beyond the safety-based considerations. Involving human factors expertise during technology design might incur additional *initial* expenses, but the costs are paid only once in the system's lifetime. The conference agreed that coping with flawed human-technology interfaces through training would result in a requirement for continuous training and higher costs.

6.3 TRAINING ISSUES

6.3.1 The conference noted that a primary objective of the ICAO Human Resource Planning and Training Needs Task is to analyse the changes to civil aviation job profiles as a result of new systems, and the consequential human resource planning and training requirements. In pursuit of this objective, ICAO completed a survey intended to quantify the training needs associated with CNS/ATM systems

implementation by identifying the amount of change that would occur, with the introduction of the new technologies, in the major jobs of civil aviation.

6.3.2 The results of the survey were presented, and the conference noted that nearly three quarters of civil aviation jobs involved in the infrastructure of international civil aviation could be expected to change as a result of the full implementation of CNS/ATM technologies. The conference also noted that, if the training development and implementation for the new systems was carried out on a State by State basis, the economic impact to an individual State could be enormous, and the magnitude of the work may have prevented a State from implementing the systems on a timely basis.

6.3.3 The ICAO strategy towards CNS/ATM training development and implementation was then considered by the conference. The strategy included: an early identification of CNS/ATM training needs and priorities; co-ordination and planning of CNS/ATM training development and implementation at the regional level; and widest possible participation in the ICAO TRAINAIR Programme by States.

6.3.4 The conference agreed that training centres need to re-assess their curricula in order to ensure that all personnel who will be involved with the planning, implementation, management, operation and maintenance of the new systems have an appropriate background in the base concepts and technologies. Such foundation training should be developed so that it addresses the specific needs of the technical and operational planners, as well as all personnel that will eventually be involved in the operation, maintenance and management of the new systems. The foundation training needed should include the following general areas:

a) CNS/ATM systems;

b) digital communications;

c) computer fundamentals;

d) computer communications, including local/wide are networks;

e) International Organization for Standardization (ISO) open systems interconnection (OSI) reference model;

f) satellite communications systems used for fixed and mobile applications;

g) satellite navigation systems;

h) automation issues;

i) fundamentals of air traffic management; and

j) aeronautical databases.

6.3.5 The conference agreed that regional training centres are an effective means of meeting the need for specialized training where it is difficult, if not impossible, for a single State to support the development and implementation of specialized training to meet national training needs alone. An exchange of information and experiences between training centres is essential to meet the future training requirements.

6.3.6 Given the considerable amount of training that will need to be developed for the new systems, as well as the need for training standardization, the conference agreed that it is imperative that plans be established for the development of the required course materials. The conference agreed that the planning method for regional training capabilities should be enhanced to meet this need and noted that there are existing structures within the ICAO Regions that would be appropriate for this type of co-ordination and planning. The conference also recalled that the training requirements associated with the implementation of the regional air navigation plans are discussed during regional air navigation meetings, but they have never been incorporated into the plan itself. The conference agreed that consideration should be given to a systems approach towards regional air navigation planning in which training forms an integral part of each plan.

6.3.7 The conference noted that the TRAINAIR Programme offers an existing framework for global co-ordination and harmonization in training development. The Programme also has a well-established and proven network for the cost-efficient sharing of course materials produced by members.

6.4 GPS OR GLONASS AS A SOLE MEANS OF NAVIGATION

6.4.1 In response to a point raised during a presentation made during this agenda item, some questions were raised concerning the reliance on GPS or GLONASS as a sole means of navigation. The conference noted that ICAO would consider these points in the ongoing development of GNSS SARPs.

6.5 CONCLUSIONS

6.5.1 On the basis of the documentation before it, the presentations made by a panel of experts and the subsequent discussions, the conference made the following conclusions:

Conclusion 6/1 – Importance of human factors and training

That human factors and training are essential to the safety, efficiency and regularity of air transport.

Conclusion 6/2 – Pro-active management of human factors issues

That, in order to maximize safety and cost-effectiveness of CNS/ATM systems, the pro-active management of human factors issues be a normal component of the processes followed by designers, providers and users of the systems.

Conclusion 6/3 – Timely consideration of human factors issues

That the time to address Human Factors issues be during technology design and before the technology is deployed into operational contexts.

Conclusion 6/4 – Human factors and training

That training plays a fundamental role in CNS/ATM systems, but should not be used as a mediator of flawed or less-than-optimum human-technology interface design.

Conclusion 6/5 – Quality of training

That a seamless global air navigation system will require an international team that is prepared to perform their jobs in such an environment, and to achieve this it is essential that personnel forming the team receive a consistent, quality level of training throughout the world.

Conclusion 6/6 – Foundation training

That Civil Aviation Training Centres provide foundation training in the basic CNS/ATM systems concepts and technologies in order to ensure a timely implementation of the systems.

Conclusion 6/7 – Use of regional training centres

That regional training centres constitute a proven means to meet specialized training needs and an effective and cost-efficient means to meeting many of the training needs associated with CNS/ATM systems.

Conclusion 6/8 – Enhancement of planning for regional training capabilities

That:

a) the planning method for regional training capabilities be enhanced;

b) planning be founded on States' aggregate demand within a region for human resources in the various aviation disciplines; and

c) decisions concerning the required "regional courses" be assessed regularly and co-ordinated through a regional planning body.

Conclusion 6/9 – Co-ordination between training centres

That the development of effective, cost-efficient and timely CNS/ATM course materials will require civil aviation training centres to co-operate and share information on a regional basis and through the ICAO TRAINAIR Programme.

Conclusion 6/10 – ICAO TRAINAIR Programme

That States participate widely in the ICAO TRAINAIR Programme in order to complement regional training planning since the programme offers a means to harmonize training and the resulting skills of personnel who will operate existing systems as well as CNS/ATM systems.

6.6 RECOMMENDATIONS

6.6.1 The conference consequently adopted the following recommendations:

Recommendation 6/11 – Timely consideration of human factors issues

That human factors issues be considered before CNS/ATM technologies are deployed, during the process of design and certification of the technology and associated standard operating procedures.

Recommendation 6/12 – Human factors regulations

That States and organizations which design and provide CNS/ATM systems will take into account ICAO guidelines when developing national regulations and incorporate Human Factors Standards in the processes of design and certification of equipment and procedures.

Recommendation 6/13 – Re-assessing training curricula

That Civil Aviation Training Centres re-assess their curricula to ensure that all personnel involved with the planning, implementation, management, operation and maintenance of the new systems receive an appropriate background in the base concepts and technologies of CNS/ATM systems.

Recommendation 6/14 – Adoption of a regional approach to CNS/ATM training

That States adopt a regional approach towards planning the development and implementation of CNS/ATM training.

Recommendation 6/15 – Role of the ICAO Regional Offices in CNS/ATM training

That the ICAO Regional Offices co-ordinate the establishment of regional training capabilities in CNS/ATM systems.

Recommendation 6/16 – Inclusion of training plans in the regional air navigation plan

That ICAO consider including regional training plans in the regional air navigation plan publications.

Recommendation 6/17 – Participation in the ICAO TRAINAIR Programme

That States increase their participation in the ICAO TRAINAIR Programme to provide a higher level of training harmonization on a global level.

Recommendation 6/18 – CNS/ATM systems course development

That the ICAO TRAINAIR Programme increase its focus on the development of CNS/ATM systems course materials.

Recommendation 6/19 – Training fellowship assistance

That:

a) in the context of technical co-operation, ICAO make arrangements to assist States in financially meeting their training needs for transition to the ICAO CNS/ATM systems in a timely and consistent manner; and

b) States and CNS/ATM partners able to contribute to this effort be encouraged to do so.

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Agenda Item 7: Conclusions and recommendations

7.1 Based on the deliberations on Agenda Items 1 to 7, the conference reviewed the conclusions and recommendations formulated during the course of the meeting. Delegates from ICAO Contracting States approved the conclusions and recommendations.

7.2 The conference authorized the President of the ICAO Council to finalize the draft declaration, taking into account the comments made by participants in the discussions under Agenda Item 7. The final declaration reads as follows:

DECLARATION ON GLOBAL AIR NAVIGATION SYSTEMS FOR THE TWENTY-FIRST CENTURY

Wishing to inform the world community about the results of its work for the 21st Century,

THE CONFERENCE DECLARES:

- its **awareness** that increasing levels of co-operation will be necessary at the national, sub-regional and global levels to ensure transparency and interoperability between CNS/ATM system elements so that the goal of a seamless, global air traffic management system can be achieved;

- its **belief** that, at the national level in some States, the operation of air navigation services by autonomous entities may contribute to significant economies and increased efficiency and transparency, as well as facilitate the raising of loans to finance the procurement and implementation of CNS/ATM systems components;

- its **consideration** of the fact that, in most cases, the financing and subsequent operation of CNS/ATM systems, in particular in the developing world, can be of common benefit to lenders, borrowers, and users alike;

- its **observation** that demonstrated sound financial management is critical to securing financing for CNS/ATM projects; in this context, and in addition to the existing financing methods, new innovative ways of financing should continue to be studied;

- its **support** for the role of ICAO's planning and implementation regional groups (PIRGs) which provide a platform for formal recognition of new air navigation facilities and services in concert with the *Global Air Navigation Plan for CNS/ATM Systems*;

- its **belief** that planning and implementation of CNS/ATM systems should be on the basis of homogeneous air traffic management areas and major international traffic flows, taking into account the diversity of technology;

- its **support** for the adoption of the draft *Charter on the Rights and Obligations of States Relating to GNSS Services* as an interim framework for the short term, while consideration is given to the long-term legal framework, including consideration of the development of a draft international convention for this purpose;

- its **support** of further work on the complex legal aspects of the implementation of CNS/ATM systems, including GNSS, which should be carried out by ICAO, with the objective to develop and build mutual confidence among States regarding CNS/ATM, and to support the implementation of CNS/ATM systems which should not be delayed by such further work; and

- its **desire** that the co-operative spirit of the conference be enshrined in this Declaration, and that this spirit form the foundation for future work by all who are involved in implementing CNS/ATM systems within ICAO's global framework.

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