CNS/ATM SYSTEMS

DEFINITION

Communications, navigation, and surveillance systems, employing digital technologies, including satellite systems together with various levels of automation, applied in support of a seamless global air traffic management system.

STRATEGIC VISION

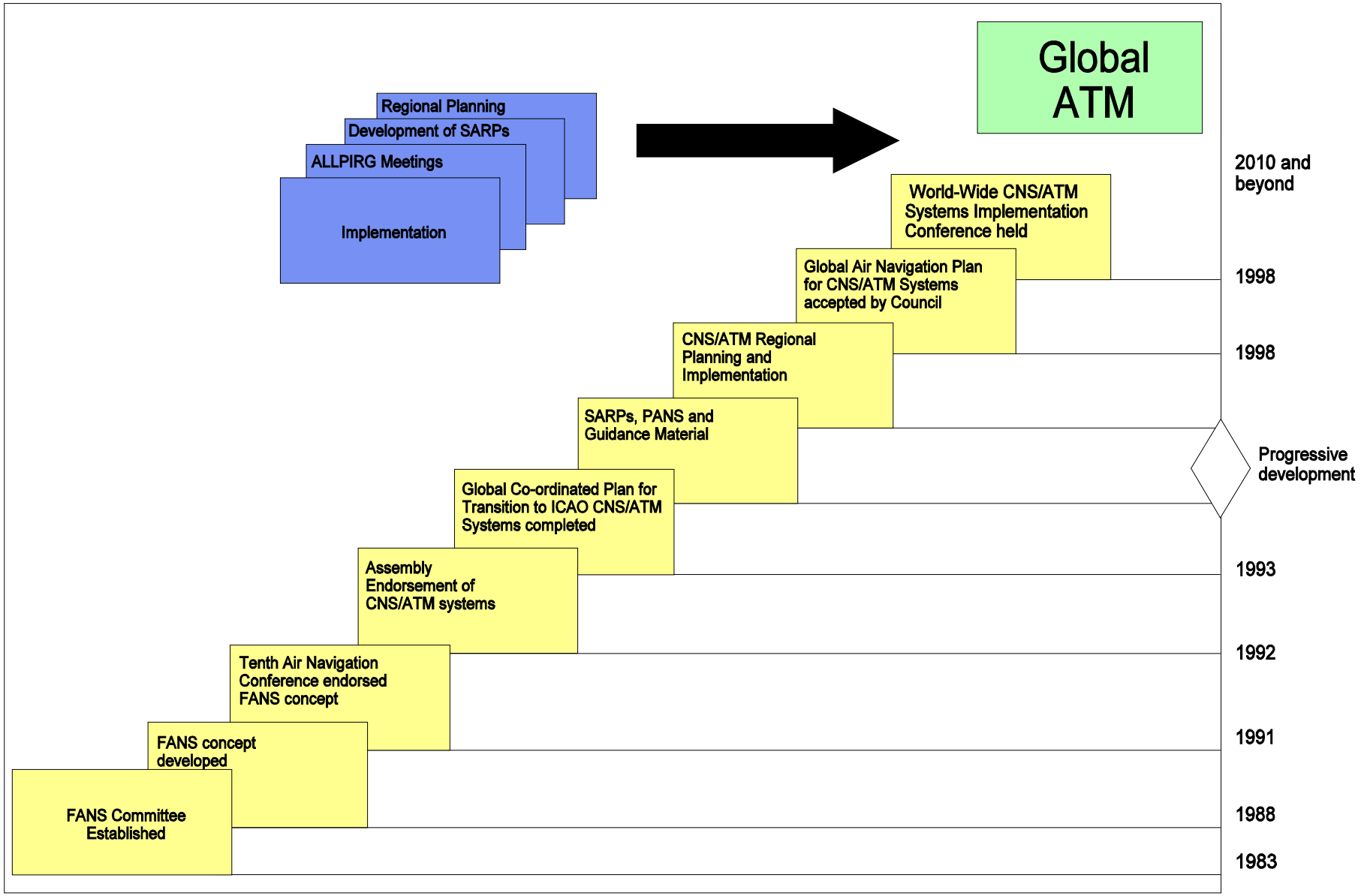
To foster implementation of a seamless, global air traffic management system that will enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints and without compromising agreed levels of safety.

MISSION OF IMPLEMENTATION

To develop a seamless, globally co-ordinated system of air navigation services that will cope with world-wide growth in air traffic demand while:

- improving upon the present levels of safety;
- improving upon the present levels of regularity;
- improving upon the over-all efficiency of airspace and airport operations, leading to increased capacity;
- increasing the availability of user-preferred flight schedules and profiles; and
- minimizing differing equipment carriage requirements between regions.

This high level executive summary was developed with the intention of presenting the reader with a synopsis of the contents, objectives and strategy of the Global Plan. This high level view provides a summary of the substantial material contained in each of the individual chapters of the Global Plan. The summary also generally describes ICAO's approach toward planning for implementation of communications, navigation and surveillance/air traffic management (CNS/ATM) systems at the global, regional and national levels, aiming at the merging of all planning into a coherent, unified strategy. Chapters of the Global Plan are indicated to the reader for easy reference to more in depth information.


Global ATM
Regional Planning
Development of SARPs
ALLPIRG Meetings
Implementation
World-Wide CNS/ATM Systems Implementation Conference held
2010 and beyond
Global Air Navigation Plan for CNS/ATM Systems accepted by Council
1998
CNS/ATM Regional Planning and Implementation
1998
SARPs, PANS and Guidance Material
Progressive development
Global Co-ordinated Plan for Transition to ICAO CNS/ATM Systems completed
Assembly Endorsement of CNS/ATM systems
1993
Tenth Air Navigation Conference endorsed FANS concept
1992
FANS concept developed
1991
FANS Committee Established
1988
1983

HISTORICAL SYNOPSIS

The FANS concept, which came to be known as the CNS/ATM systems, involves a complex and interrelated set of technologies, dependent largely on satellites.

In 1983, the Council of ICAO determined that the systems and procedures supporting civil aviation had reached their limits, and established the Special Committee on Future Air Navigation Systems (FANS Committee). In concluding their work in 1989, the FANS Committee determined that it would be necessary to develop new systems that would overcome limitations of conventional systems and allow air traffic management (ATM) to develop on a global scale. In July 1989, the ICAO Council established the Special Committee for the Monitoring and Co-ordination of Development and Transition Planning for the Future Air Navigation System (FANS Phase II Committee). In October 1993, the FANS Phase II Committee completed its work. The FANS Phase II Committee recognized that implementation of related technologies and expected benefits would evolve over a period of time.

In September 1991, the Tenth Air Navigation Conference endorsed the concept for a future air navigation system as developed by the FANS Committees. The FANS concept, which came to be known as the CNS/ATM systems, involves a complex and interrelated set of technologies, dependent largely on satellites.

BENEFITS

CNS/ATM systems will improve the handling and transfer of information, extend surveillance and improve navigational accuracy.

CNS/ATM systems will improve the handling and transfer of information, extend surveillance and improve navigational accuracy. This will lead to, among other things, reductions in separation between aircraft, allowing for increased airspace capacity. Advanced CNS/ATM ground-based systems will exchange data directly with flight management systems aboard aircraft through data link. This will benefit the ATM provider and airspace user by enabling improved conflict detection and resolution through intelligent processing, providing for the automatic generation and transmission of conflict free clearances, as well as offering the means to adapt quickly to changing traffic requirements. As a result, the ATM system will be better able to accommodate an aircraft's preferred flight profile and help aircraft operators to achieve reduced flight operating costs and delays.

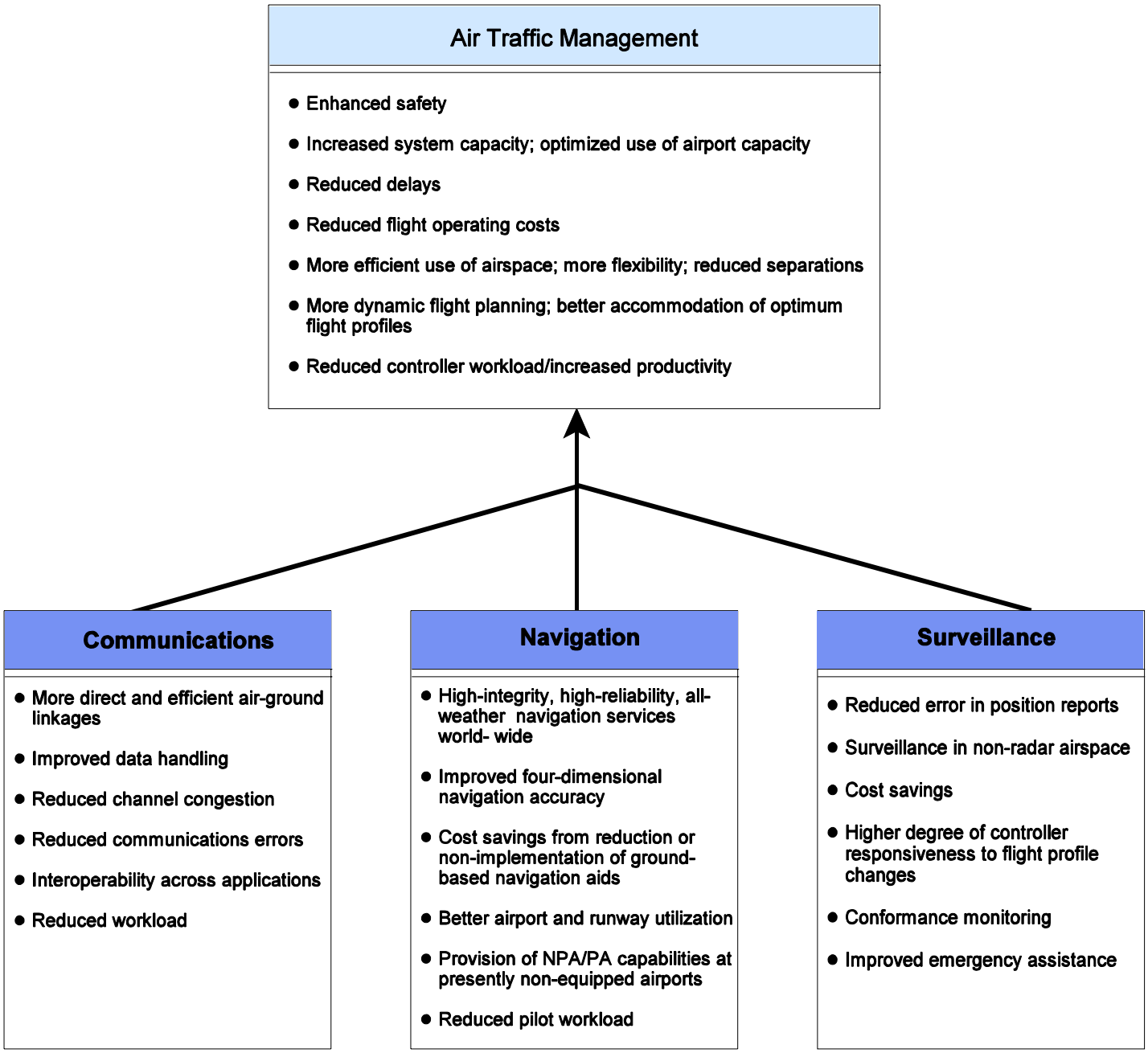
GLOBAL PLANNING

The first plan of action was the ICAO Global Co-ordinated Plan for Transition to ICAO CNS/ATM Systems.

In order to progress toward implementation of CNS/ATM systems, a plan of action was needed. The first such effort towards developing a plan was the ICAO Global Co-ordinated Plan for Transition to ICAO CNS/ATM Systems. In 1996, the ICAO Council recognized that this plan had served its purpose well and had made a significant contribution toward realizing the vision established by the FANS Committee. However, the Council concluded that the CNS/ATM systems had matured and, therefore, a more concrete plan which would include all developments, while putting focus on regional implementation, was required.

In 1996 the Council directed the ICAO Secretariat to revise the Global Plan as a "living document".

In 1996 the Council directed the ICAO Secretariat to revise the Global Plan as a "living document" comprising technical, operational, economic, financial, legal and institutional elements, offering practical guidance and advice to regional planning groups and States on implementation and funding strategies, which should include technical co-operation aspects. These aspects of CNS/ATM systems are addressed in the Global Air Navigation Plan for CNS/ATM Systems.



A high-level view of expected benefits of the new systems

PLANNING STRUCTURE

The Global Plan has been developed so that it has a clear and functional relationship with the regional air navigation plans.

The tables in Volume II will form the framework to guide the implementation of CNS/ATM systems on a global basis.

The Global Plan has been developed so that it has a clear and functional relationship with the regional air navigation plans. This has been accomplished by dividing the Global Plan into two parts. Volume I will guide further development of the operational requirements and planning criteria of the regional air navigation plans. The tables in Volume II will form the framework to guide the implementation of CNS/ATM systems on a global basis, using the traditional regional planning processes, leading to a global, integrated ATM system. The document will therefore offer, under one cover, a global snapshot of progress achieved and work remaining toward implementation of CNS/ATM systems, thereby serving as a consolidated planning tool.

ATM OPERATIONAL CONCEPT

The Global Plan broadly describes an ATM operational concept.

The Global Plan broadly describes an ATM operational concept being developed by ICAO, reflecting latest available information on ATM conceptual work. This description and emerging concept will offer a high-level vision in order to assist in the determination of ATM requirements that would guide the development of future CNS/ATM system elements and their functionalities, thereby allowing optimum benefits to be attained.

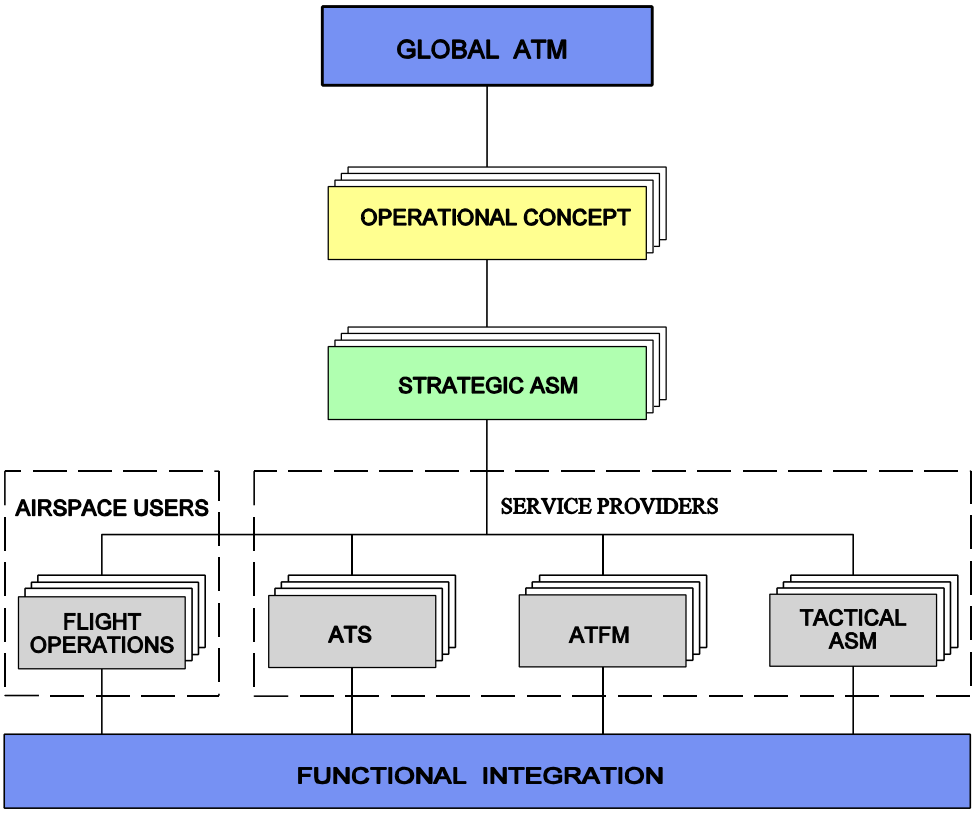
ELEMENTS OF THE GLOBAL PLAN

COMMUNICATIONS (Chapter 5)

Communications will increasingly take place via digital data link.

The regular use of data transmission for ATM purposes will offer many new possibilities and opportunities.

With CNS/ATM systems, communications will increasingly take place via digital data link over existing communications channels. Satellite data and voice communications, capable of global coverage are also being introduced. Secondary surveillance radar Mode S, which is increasingly being used for surveillance in high-density airspace, also has the capability of transmitting digital data between air and ground. An aeronautical telecommunications network will provide for the interchange of digital data between end users over dissimilar air-ground and ground-ground communication sub-networks. The regular use of data transmission for ATM purposes will introduce many changes in the way that communication between air and ground takes place, and will at the same time offer many new possibilities and opportunities.



A structured approach to the work on global ATM

NAVIGATION (Chapter 6)

Improvements in navigation include the progressive introduction of area navigation (RNAV) capabilities along with the global navigation satellite system (GNSS).

Improvements in navigation include the progressive introduction of area navigation (RNAV) capabilities along with the global navigation satellite system (GNSS). These systems provide for world-wide navigational coverage and are being used for world-wide en-route navigation and for non-precision approaches. With appropriate augmentation systems and related procedures, it is expected that these systems will also support most precision approaches.

SURVEILLANCE (Chapter 7)

Aircraft will automatically transmit their position and other data such as heading, speed and other useful information contained in the flight management system, via satellite or other communication links, to an air traffic control (ATC) unit.

Traditional secondary surveillance radar modes will continue to be used for surveillance, along with the gradual introduction of Mode S in both terminal areas and high-density continental airspace. The major breakthrough however, is with the implementation of automatic dependent surveillance (ADS). Using ADS, aircraft will automatically transmit their position, and other data such as heading speed and other useful information contained in the flight management system, via satellite or other communication links, to an air traffic control (ATC) unit. Software is currently being developed that would allow these data to be used directly by ground computers to detect and resolve conflicts. ADS-broadcast (ADS-B) is another concept for dissemination of aircraft position information. Using this method, aircraft periodically broadcast their position to other aircraft as well as to ground systems.

AIR TRAFFIC MANAGEMENT (Chapter 4)

The advancements in CNS technologies will serve to support ATM.

When considering implementation of new communications, navigation and surveillance systems and all of the expected improvements, it can be seen that the advancements in CNS technologies will serve to support ATM. When referring to ATM in the future concept, much more than just air traffic control is meant. In fact, ATM will include air traffic services, air traffic flow management, airspace management and the ATM-related aspects of flight operations. An integrated global ATM system should fully exploit the introduction of new technologies through international harmonization of standards and procedures. Ultimately, this would enable the aircraft operators to conduct their flights in accordance with their preferred trajectories, dynamically adjusted, in the most optimum and cost-efficient manner.

METEOROLOGY (Chapter 8)

The global ATM system will require access to global meteorological information on a far shorter time scale than has been customary in the past.

The global ATM system will require access to global meteorological information on a far shorter time scale than has been customary in the past. In many cases virtually "instant" access, including real-time data, will be required. Such stringent requirements will dictate that as many of the processes as possible must be automated. Development of the meteorological systems to support a global ATM system is taking place, specifically in, among others, the automatic uplink of aerodrome weather observations to aircraft on approach or departure, and dedicated systems to detect hazardous weather; and, automatic downlink of meteorological information derived from aircraft sensors (wind, temperature, turbulence and humidity) to ATC computers.

AERONAUTICAL INFORMATION SERVICES (Chapter 9)

With the increased quantity of aeronautical information and with the clearly defined operational requirement for aeronautical data quality, the emerging aeronautical databases are improving, among other things, the speed, efficiency and cost-effectiveness of aeronautical information.

For CNS systems to provide maximum benefits through enhanced ATM, the support of aeronautical information services is essential. The role and importance of aeronautical information will continue to change significantly with the implementation of area navigation, required navigation performance (RNP) and airborne computer-based navigation systems. An integrated ATM system along with the requirement for precise navigation capability will therefore require high quality aeronautical information in order to be able to provide guidance for gate to gate operations between origin and destination.

With the increased quantity of aeronautical information and with the clearly defined operational requirement for aeronautical data quality, the emerging aeronautical databases are improving, among other things, the speed, efficiency and cost-effectiveness of aeronautical information. For these reasons, many States have begun or are planning to begin developing electronic aeronautical databases with the intent to use such data to prepare and update their aeronautical information publications and/or to exchange electronic aeronautical information between all parties concerned.

HUMAN RESOURCE DEVELOPMENT AND TRAINING NEEDS (Chapter 10)

A seamless air navigation environment will require an international team that is prepared to perform their jobs in such an environment.

A major goal of CNS/ATM systems is to create a seamless global air navigation system. A seamless air navigation environment will require an international team that is prepared to perform their jobs in such an environment. To achieve this, it is essential that personnel throughout the world who will form this team receive a consistent, quality level of training. The evolution of aviation technologies has been gradual in the past, and trainers have, for the most part, been able to meet the challenges associated with change even though sophisticated training methodologies and tools have not always been at their disposal. However, the new CNS/ATM

systems are based on many new concepts, and their implementation presents a greater challenge to trainers.

LEGAL ISSUES (Chapter 11)

It has been generally agreed that there is no legal obstacle to the implementation of CNS/ATM systems and that there is nothing inherent in CNS/ATM systems which is inconsistent with the Chicago Convention.

The legal framework for provision of air traffic management services currently in place, the Chicago Convention and its Annexes, governs the conduct of services providers (including providers of elements of the services, such as navigation aid positioning signals), and users (including air operators). CNS/ATM systems will bring significant benefits to States. There is a consensus that GNSS shall be compatible with the Chicago Convention, its Annexes and other principles of international law.

ORGANIZATIONAL AND INTERNATIONAL CO-OPERATIVE ASPECTS (Chapter 12)

States will need to co-operate in order to ensure optimal benefits from the efficiency CNS/ATM systems offer.

Implementation of CNS/ATM systems will be facilitated where financially-autonomous bodies have been established to operate air navigation services.

Two important characteristics of major CNS/ATM components are their capacity to serve a large number of States, even regions of the world, and the major investments usually involved in their implementation. This has organizational implications because States will need to co-operate in order to ensure optimal benefits from the efficiency CNS/ATM systems offer. The structure of the international co-operative effort required will differ depending on the implementation option chosen for a specific system's component and the States involved. The international co-operative effort can be in the form of an International Operating Agency, a Joint Charges Collection Agency or an ICAO Joint Financing Arrangement.

At the national level, implementation of CNS/ATM systems will be facilitated where financially-autonomous bodies have been established to operate air navigation services. Such authorities may also operate airports or be in the form of an autonomous civil aviation authority. Whether at the national or international level, financing of CNS/ATM systems components as well as other air navigation services infrastructure will be enhanced where such autonomous bodies are responsible for infrastructure provision and operation.

COST/BENEFIT AND ECONOMIC IMPACT (Chapter 13)

The providers of air traffic services, the users of these services and financing organizations all need to be advised of the financial implications and convinced of the economic viability of new CNS/ATM systems.

To ensure the successful implementation of CNS/ATM systems, the providers of air traffic services, the users of these services and financing organizations all need to be advised of the financial implications and convinced of the economic viability of new CNS/ATM systems. This can be achieved through a comprehensive cost/benefit analysis which includes the financial consequences affecting all the partners involved in the implementation process. Cost/benefit analysis can also provide guidance on the appropriate timing for implementation of various elements of a new system. In addition, to demonstrate the financial viability, business cases for homogeneous ATM areas could be conducted at the regional, sub-regional or national level.

The implementation of CNS/ATM systems will contribute positively towards the economic impact of civil aviation and could also improve the environmental impact.

FINANCIAL ASPECTS (Chapter 14)

The costs of CNS/ATM systems elements could be recovered in accordance with ICAO policy guidance.

The costs of CNS/ATM systems elements could be included in the cost basis for air navigation services charges and, where relevant, airport charges, and recovered in accordance with the principles contained in the *Convention on International Civil Aviation* (Doc 7300) and the *Statements by the Council to Contracting States on Charges for Airports and Air Navigation Services* (Doc 9082).

Financing of basic systems elements may, in many cases, need to be a joint venture by the States involved at the regional or global level.

Financing of CNS/ATM systems elements, in particular at the national level, would normally be approached in a manner similar to that applied to conventional air navigation systems. However, a characteristic of most CNS/ATM systems elements which differentiates them from conventional air navigation systems is their multinational dimension. Consequently, and because of the magnitude of the investments involved, financing of basic systems elements may, in many cases, need to be a joint venture by the States involved at the regional or global level.

ASSISTANCE REQUIREMENTS AND TECHNICAL CO-OPERATION (Chapter 15)

Assistance requirements of developing States in particular, need to be addressed.

Planning and implementation of CNS/ATM systems requires co-operation among all partners that have a stake in its successful implementation. Assistance requirements of developing States in particular, need to be addressed. Technical and financial co-operation of the aviation and development financing communities will be required world-wide with the co-ordination of ICAO to ensure harmony and safety.

SUMMARY

Implementation of CNS/ATM systems is already taking place in order to achieve early benefits.

The emerging technologies will support a variety of systems designs and implementation options. The challenge for the planner and designer is to develop an adequate understanding of the costs, benefits and operational suitability of these alternatives while considering the legal, organizational and financial aspects; and to orchestrate a co-ordinated programme of ATM improvements that takes into account user needs, their willingness to upgrade their capabilities to achieve operational benefits, and also to pay for the changes required by ATM services providers. The revised Global Plan is intended to guide the international aviation community toward meeting this challenge and implementing CNS/ATM systems.

There are still a number of issues that will have to be dealt with and overcome if all of the possible benefits of CNS/ATM systems are to be fully exploited. This will involve the combined effort and goodwill of both ATM providers and users of the system. Overall, the CNS/ATM systems is being viewed upon favourably by all. Implementation of CNS/ATM systems is already taking place in order to achieve early benefits.

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