INTERNATIONAL CIVIL AVIATION ORGANIZATION

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ICAO SPECIAL IMPLEMENTATION PROJECT (SIP)

WORKSHOP ON THE DEVELOPMENT OF BUSINESS CASE FOR THE IMPLEMENTATION OF CNS/ATM SYSTEMS

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REPORT ON GLOBAL AND REGIONAL DEVELOPMENTS IN THE MODERNIZATION OF AIR NAVIGATION SYSTEMS

SUMMARY

This paper presents an overview of the global and regional developments in the modernization of air navigation systems. The paper provides the current status of ICAO provisions relating to CNS/ATM systems, a summary of the work of relevant panels and study groups, textual and tabular representations of regional developments, a set of general observations and recommendations.

Proposed action by the workshop is at paragraph 4.

1. INTRODUCTION

1.1 This report provides information on the status of the programmes of the relevant Air Navigation Commission panels, the Secretariat, the Planning and Implementation Regional Groups (PIRGs) and regional developments. These programmes and resultant developments are designed to modernize the air navigation infrastructure worldwide in order to provide increased airspace/airport capacity, higher operational efficiency, higher levels of aviation safety and better service regularity. The term "modernization" refers to building on existing air navigation systems, focussing mainly on emerging technologies, such as satellites and data links for improved communication, navigation and surveillance functions, thus making the advanced air traffic management concepts feasible.

1.2 The Commission recognizes that work related to air navigation systems and, in particular, development and implementation, continue to rank among the highest priority items on ICAO's work programme. Therefore, there was a need for timely completion of the necessary SARPs, PANS and guidance material, in order to provide a sound basis for implementation of emerging new air navigation systems. Through its panels and the Secretariat, assisted by study groups, the Commission progressed the development of SARPs, PANS and guidance material, as described in Section 2 of this paper. A summary of near-term

future developments activities and highlights of the World radiocommunication Conference (WRC-2003) and Eleventh Air Navigation Conference are also shown in the paper. Some relevant general observations are presented in Section 3.

1.3 The work of PIRGs and other implementation activities are summarized in Appendix A. A summary of the development status of air navigation systems-related SARPs, PANS and guidance material is in Appendix B to this paper. A summary of the recent main activities of panels of the Commission and study groups involved in CNS/ATM-related activities is provided in a tabular form in Appendix C. Finally, a tabular representation of regional developments is presented in Appendix D.

2. SARPS, PANS AND GUIDANCE MATERIAL RELATED TO AIR NAVIGATION SYSTEMS

2.1 Recent developments

Communications

2.1.1 A manual on very high frequency (VHF) digital link (VDL) Mode 3 was published. The development of SARPs for the universal access transceiver (UAT) serving as a data link for automatic dependent surveillance-broadcast (ADS-B) applications was initiated. Work continued on the relocation of detailed technical specifications of the aeronautical mobile-satellite service (AMSS) into a technical manual and on the integration of next-generation satellite systems (NGSS) specifications with AMSS material. Work commenced on the development of guidelines on the operational use of the public Internet for aeronautical applications.

Navigation

2.1.2 Pursuant to the incorporation of the first package of GNSS SARPs in Annex 10 — *Aeronautical Telecommunications* and subsequent enhancements thereto, work began on the development and validation of SARPs for new GNSS elements and signals, such as modernized Global Positioning System (GPS), the GLObal NAvigation Satellite System (GLONASS) and GALILEO. Procedures for Category I approaches using ground-based augmentation system (GBAS) and departures using satellite-based augmentation system (SBAS) were developed.

Surveillance

2.1.3 Amendments to the *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168) relating to collision avoidance system (ACAS) were adopted in 2003 to strengthen operational procedures and to provide guidelines for pilot training. Additionally, guidance material on airborne separation assistance system (ASAS) was developed which will be presented to the Commission for review in early 2004. Progress was also made on the definition of required surveillance performance (RSP).

Air traffic management

2.1.4 Manuals on Advanced Surface Movement Guidance and Control Systems (A-SMGCS), Safety Management for Air Traffic Services, and Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) were finalized and are expected to be published in 2004. The *Air Traffic Services*

Planning Manual (Doc 9426) and the *Manual on Required Navigation Performance (RNP)* (Doc 9613) were updated and are expected to be published before the end of 2003. Comprehensive guidance material on contingency planning, along with associated provisions, were included in Annex 11 — *Air Traffic Services*. This material will assist States in the development of national contingency plans. A runway incursion education and awareness campaign began with a series of worldwide seminars to promote the implementation of runway safety programmes in the States. A toolkit with educational material, including references to relevant ICAO SARPs is under development.

Regional human resource planning and training needs for CNS/ATM implementation

2.1.5 The draft human resource planning manual was completed in 2003. The aim of the manual is to enhance States' individual capabilities in this area. To ensure that the manual fully meets States' and/or air navigation service providers' needs and is sufficiently user-friendly, validation tests were conducted during two Regional Human Resource Planning Seminars that were held in 2003 in the Caribbean and South American (CAR/SAM) Regions and the Eastern and Southern African Regions. Once the manual is approved, the Secretariat plans to organize regular human resource planning seminars to assist States in developing and implementing their training and staffing plans.

2.1.6 The human resource planning manual is a fundamental element in the overall strategy to ensure that training needed to implement new and emerging air navigation systems is available. The other key element is the implementation of a regional training planning process. The aim of this process is to ensure that the training needed to implement regional air navigation plans is accessible and affordable within all ICAO Regions. The specific steps and procedures that could form the basis of a regional training planning process were developed by the Secretariat. To ensure that the planning process meets the needs of a region, it will need to be reviewed and adapted as necessary by the PIRG concerned. The CAR/SAM Regions will be the first to consider implementation of the process.

Safeguarding the aeronautical radio frequency spectrum

2.1.7 An important element in the modernization of air navigation systems is the continuing availability of adequate radio frequency (RF) spectrum. At the World Radiocommunication Conference of the International Telecommunication Union (ITU), which was held from 9 June to 4 July 2003 (WRC-2003), a number of key issues relating to aviation RF spectrum were addressed. These included the continuing availability of RF spectrum for microwave landing system (MLS), radar systems and distance measuring equipment (DME). The conclusions of the WRC-2003 were in conformity to the ICAO position on these issues and can therefore be considered as very satisfactory. Also, provisions enabling the introduction of improvements to GNSS systems were completed, taking due account of the need for the protection of current aeronautical systems operating in the GNSS frequency bands (DME and primary surveillance radar). These provisions include the future use of RF spectrum for GBAS.

2.1.8 Of particular importance was the decision of the conference to place on the agenda for the next World Radiocommunication (scheduled to take place in 2007), work related to the identification and allocation of new spectrum for aeronautical services that are expected to be required to accommodate new data link applications. Details on the outcome of the WRC-03 have been presented and discussed at the Eleventh Air Navigation Conference under Agenda Item 5.

Eleventh Air Navigation Conference

2.1.9 The Eleventh Air Navigation Conference, which was held in Montreal from 22 September to 3 October 2003, addressed several CNS and ATM issues aimed at facilitating the evolution of the global air traffic management system. A brief summary of the outcome of the conference, which has relevance to the modernization of air navigation systems is given below. The entire report of the conference will be reviewed and reported upon by the Air Navigation Commission in the usual manner.

2.1.10 Concerning ATM matters, the conference endorsed a global ATM operational concept to serve as a global vision for the implementation of CNS/ATM systems and technologies and developed several recommendations for further work which included the development of ATM requirements. The conference also reviewed several enabling technologies and endorsed a concept of use for ADS-B which will facilitate the implementation of this important technology.

2.1.11 All aspects of safety, particularly as it relates to the future global ATM system were addressed by the conference. A framework for a systems approach to safety was agreed upon and ICAO's new *Manual on Safety Management for Air Traffic Services* which will assist States in their implementation of safety management programmes, was well received. Some important recommendations on safety certification and regulation were also developed.

2.1.12 The conference reviewed several matters related to performance of the ATM system. It was agreed that the future ATM system should be a performance-based system and that several aspects of performance must be measured. The concept of required total system performance (RTSP) was reviewed by the conference and several recommendations for further work in the field of performance were agreed to.

2.1.13 The conference addressed capacity enhancement measures taken by States and regions to accommodate the increasing traffic. At the same time, the conference stressed the importance of runway safety and made several recommendations which would encourage States to implement runway safety programmes to ensure that as capacity increases, runway safety is not eroded.

2.1.14 With regard to radio frequency spectrum matters, the conference noted the outcome of WRC-03 and in particular the continuing availability of existing aeronautical radio-frequency spectrum that would be required to modernize air traffic systems through the implementation of newly developed systems in ICAO. The conference further agreed to the outline of the future work to be undertaken in ICAO to ensure the availability of sufficient and protected spectrum for new aeronautical systems in the post-2020 time frame.

2.1.15 In the area of navigation the conference reviewed up-to-date information on GNSS status, vulnerability aspects and interference mitigation, future system architecture and levels of service that could be provided at the various stages of system evolution. The conference re-confirmed the ultimate goal of transition to satellite-based navigation for all phases of flight, and the role of conventional radio navigation aids and RNAV capability as a GNSS back-up. The conference developed guidance on gradual introduction of satellite-based navigation in support of RNAV and RNP operations and recommended appropriate revisions to the navigation sections in the *Global Air Navigation Plan for CNS/ATM Systems* (Doc 9750). In addition, updates to the ICAO strategy for introduction and application of non-visual aids to approach and landing in Annex 10 were recommended. Moreover, the conference recommended that provisions relating to the integration of inertial navigation system (INS) with GNSS be developed to reduce the vulnerability of the latter to radio frequency interference.

2.1.16 The conference reviewed the development of air-ground and air-air communication systems, and formulated a strategy for the introduction and longer term development of ADS-B. It also developed an evolutionary approach for global interoperability of air-ground communication and recommended further investigation of future technology alternatives. In this connection, a set of guidelines on standardization of new communication technologies was endorsed.

2.1.17 The conference reviewed ICAO provisions relating to the operation of airborne collision avoidance system (ACAS) and discussed the role of ACAS in the future ATM environment. It was recommended by the conference that appropriate measures be taken in order to make more effective use of ACAS and to make its data available to ground control.

2.2 Near-term (until 2005) activities

Communications

2.2.1 The development of draft SARPs for the UAT will continue. Frequency assignment criteria for VDL Modes 3 and 4 will be finalized. Further investigation of future aeronautical mobile communication scenarios will be conducted. As for the aeronautical telecommunication network (ATN), provisions will be developed for the use of Internet Protocol (IP) networks and the optional use of the confidentiality feature (for message encryption) within the existing aeronautical information security framework (as reflected in ATN SARPs contained in Annex 10). Work will continue on the development of guidelines and possibly other provisions relating to the use of the public Internet for non-time critical aeronautical applications.

Navigation

2.2.2. Considering the introduction of the first SBAS (wide area augmentation system (WAAS) in the United States) and forthcoming introduction of other similar systems in 2004-2006 time frame, a number of States plan the implementation of procedures for SBAS-based approaches with vertical guidance (APV) as the first step in transition to satellite-based navigation. Development of performance requirements and SARPs for more demanding GNSS applications (e.g. precision approaches for CAT II/III operations) and new GNSS elements (e.g. GALILEO, ground-based regional augmentation system (GRAS)) will continue. Current studies of interference to GNSS signals and mitigation methods, including the assessment of ionospheric effects on SBAS performance in equatorial areas will be ongoing. Implementation of GNSS (mainly GPS) based non-precision approach (NPA) will be continued in ICAO Regions. These activities were supported by the development of procedures and criteria for approaches with vertical guidance (APV-baro VNAV) and Category I operations based on GBAS. The development of criteria for SBAS arrival/precision approach procedures as well as APV-I and APV-II will continue.

Surveillance

2.2.3 Issues relating to the operational use of ACAS, ADS-B and the proposed ASAS will be addressed. Implementation of ACAS worldwide will be monitored and ACAS procedures for civil aircraft operation in case of interception by military aircraft will be further studied.

Flight Safety and Human Factors Programme

2.2.3 A review of the *Human Factors Training Manual* (Doc 9683) was completed in 2003, specifically of Part 1, Chapter 3 (Human Factors issues in the development and implementation of CNS/ATM systems) and Chapter 5 (Human Factors issues in air traffic control). The objective of this review was to bring the document in line with the manual *Human Factors Guidelines for Air Traffic Management (ATM) Systems* (Doc 9758), as well as to include the latest developments since Doc 9683 was published. Constant monitoring of developments within the industry will continue in order to take appropriate action as developments warrant.

3. GENERAL OBSERVATIONS

3.1 The Commission noted that the general observations made in the previous annual report were still valid. It was particularly noted that although good progress had been made with implementation of certain elements of CNS/ATM systems, the overall pace of implementation was understandably slower than originally expected. In this context, the Commission recalled with interest that the deliberations and recommendations of the Eleventh Air Navigation Conference had been helpful to the process of planning and implementation of air navigation systems. In concluding the Commission requested the Secretary General to invite PIRGs and States to enhance their activities in the area of planning and implementation of CNS/ATM systems.

4. ACTION BY THE WORKSHOP

4.1 The workshop is invited to:

a) note the information provided in this working paper; and

b) take into account in the development of business case for the implementation of CNS/ATM systems.

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APPENDIX A

REGIONAL PLANNING AND IMPLEMENTATION ACTIVITIES RELATED TO AIR NAVIGATION SYSTEMS

1. Regional plans

Note.— The following paragraphs summarize the major planning activities which have been reported by recent meetings of the PIRGs.

AFI Planning and Implementation Regional Group

1.1 The fourteenth meeting of AFI Planning and Implementation Regional Group (APIRG/14), held in Yaoundé, Cameroon, in June 2003, focussed on the implementation of regional air navigation plans and associated ICAO provisions. The meeting identified the critical circuits and examined the use of public data networks (PDNs) or integrated services digital networks (ISDNs) for upgrading aeronautical fixed telecommunication network (AFTN) circuits. The meeting was informed that, to date, only South Africa (Johannesburg and Cape Town airports), and the Réunion Islands (St. Denis airport) had received specific indications by airlines wishing to operate the new larger aircraft (NLA), in particular the A380 due to enter commercial operation, in the first quarter of 2006.The meeting acknowledged the efforts recently undertaken by number of States in extending VHF coverage on various air traffic services (ATS) routes through the use of remote VHF stations. With reference to proposed implementation of reduced vertical separation minimum (RVSM) with a target date of January 2005, the meeting recognized the need to develop an implementation strategy, including a formal risk assessment, and to establish a safety management process in order to ensure that an acceptable level of safety can be achieved and maintained. It was agreed that SBAS operational system based on European Geostationary Navigation Overlay Service (EGNOS) should be implemented in the Africa-Indian Ocean (AFI) Region starting with the deployment of a preoperational system. Responding to the changing needs that called for a fresh approach in planning and implementation of air navigation systems, APIRG suggested a revision to its terms of reference.

ASIA/PAC Air Navigation Planning and Implementation Regional Group

1.2 The fourteenth meeting of ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG/14), which took place in Bangkok, Thailand, in August 2003, focused on the development of the region's air navigation system infrastructure, and marked a major milestone by completing preparations for implementing RVSM in airspace over the Bay of Bengal and beyond, in conjunction with planned RVSM implementation in the Middle East Region effective 27 November 2003. The meeting adopted Mode S Extended Squitter as the data link for ADS-B for the near term applications and encouraged the States of Asia Pacific (ASIA/PAC) Region to implement ADS-B for ground-based surveillance with a target date of January 2006. It reviewed the draft regional procedures for identification, assessment, reporting and monitoring of the status of air navigation deficiencies as a supplement to the uniform methodology, which is expected to be finalized by early 2004 for its implementation by the States.

Recognizing the need for an airspace system performance monitoring structure for the ASIA/PAC Region, which would provide a framework for safety monitoring services for the implementation of reduced separation minima and CNS/ATM applications such as automatic dependent surveillance (ADS) and controller-pilot data link communications (CPDLC), the meeting established a Regional Airspace Safety Monitoring Advisory Group with immediate effect. Noting the success achieved at WRC 2003, the ongoing efforts to protect the aeronautical frequency spectrum were reviewed by the meeting and called on States to support ICAO's position through the participation in a number of regional forums. Other topics of discussion included increasing the efficiency of the regional planning process, meteorology applications and environmental issues with emphasis on the benefits made possible by implementing CNS/ATM systems. Responding to the changing needs that called for a fresh approach in planning and implementation of air navigation systems, APANPIRG suggested a revision to its terms of reference.

Caribbean and South American Planning and Implementation Regional Group

1.3 The eleventh meeting of the Caribbean/South American (CAR/SAM) Regional Planning and Implementation Group (GREPECAS/11) was held in Manaus, Brazil, in December 2002. The major activities undertaken by GREPECAS are as follows: regional agreement for the implementation of RVSM in the Caribbean/South America (CAR/SAM) Regions in conjunction with the planned implementation in the United States domestic airspace and southern Canadian airspace with effect from 20 January 2005; establishment of a CAR/SAM regional RVSM monitoring agency and the assignment of this task to Brazil; and establishment of a CAR/SAM regional bird hazard prevention committee. In addition, the meeting called on States to do similar establishment of committees at aerodromes and at national levels. On the subject of protection of the aeronautical frequency spectrum, the region is addressing this issue in a number of fora, such as meetings of Directors General of Civil Aviation and regional preparatory meetings. To expedite the process in resolving the deficiencies, a safety assessment tool that would help in analyzing and prioritizing the deficiencies to be addressed has been developed. Furthermore, the meeting called upon States to adopt the project outline developed by CAR/SAM Regional Planning and Implementation Group (GREPECAS) for the commitment of resources to correct deficiencies. On the subject of GNSS augmentation, GREPECAS agreed for SBAS trials in the CAR/SAM Region using the EGNOS platform. Development of a regional strategy for the introduction of ATM automation in the CAR/SAM regions continues to be ongoing task of GREPECAS. The meeting also strongly supported GREPECAS efforts with regard to the aviation security programme. Responding to the changing needs that called for a fresh approach in planning and implementation of air navigation systems, GREPECAS suggested a revision to its terms of reference.

European Air Navigation Planning Group

1.4 The forty-fourth meeting of the European Air Navigation Planning Group (EANPG/44) was convened in Paris, France in December 2002. A proposal to create a single European upper flight information region (UIR) above flight level (FL) 285, with effect from January 2005, was noted. The meeting was of the view that a division of the European (EUR) Region into component parts was highly undesirable and should be avoided. The EANPG decided that a coordinated plan to expand RVSM in the EUR Region should be developed and that a common implementation date should be agreed upon. The meeting supported further development of the Aeronautical Information Management Strategy as part of a

seamless global information management concept that should encompass all airspace users and all phases of flight. With regard to deficiencies, specifically in connection with the implementation of RVSM, the meeting noted with concern the presence of non-RVSM-approved civil aircraft in RVSM airspace due to either flight planning errors or deliberate abuse of the system. EANPG reviewed its role and activities and, as a result of changing needs, revised its terms of reference. It was noted that several of the most important current regional activities — such as "Single European Sky", airspace harmonization issues, RVSM safety performance monitoring and 8.33 kHz channel-spacing — would require annual meetings for their successful advancement.

Middle East Air Navigation Planning and Implementation Regional Group

1.5 The eighth meeting of the Middle East Air Navigation Planning and Implementation Regional Group (MIDANPIRG/8) was held in Cairo, Egypt, in September 2003. The major activities undertaken in the field of air navigation are as follows: the draft MID Basic air navigation plan (ANP) and facilities and services implementation document (FASID) have been finalized and will undergo technical and editorial verification at ICAO Headquarters; final preparations and interregional coordination with the ASIA/PAC and EUR Regions have been completed as a part of the project to implement RVSM in the MID Region effective from 27 November 2003; and a Middle East Central Monitoring Agency (MECMA) has been established with initial focus on monitoring RVSM implementation. The terms of reference of MECMA were revised to include additional tasks for carrying out safety and airspace monitoring in respect of required navigation performance (RNP) and area navigation (RNAV) implementation; and a feasibility study for establishing a Middle East Regional very small aperture terminal (VSAT) network for ground-ground data/voice communications has been completed. The Middle East States are to obtain necessary authorization from the respective telecommunications regulatory authorities and to provide feedback in order to proceed with the design phase of the project; an ATN transition plan is under development, with an initial focus on implementation of ground-ground applications such as ATS message handling system (AMHS) and air traffic services (ATS) interfacility data communications (AIDC); the MID Regional plan for CNS/ATM systems has been reviewed and updated; the deficiencies of the Middle East Region were reviewed and addressed as a part of MIDANPIRG's work programme; and to expedite the process of resolving the deficiencies, a dedicated Safety Working Group has been established. Noting the success achieved at WRC 2003, the meeting reviewed its ongoing efforts to protect the aeronautical frequency spectrum and called upon States to refrain from using or allocating the band 1 559-1 610 MHz to fixed service. Responding to the changing needs that called for a fresh approach in planning and implementation of air navigation systems, MIDANPIRG suggested a revision to its terms of reference.

North Atlantic Systems Planning Group

1.6 The thirty-ninth meeting of the North Atlantic systems planning group (NAT SPG/39) took place in Paris, France, in June 2003. The NAT SPG carried out a review of the air navigation system safety performance for the NAT Region. It confirmed that during 2002, the risk levels in the horizontal plane were within the target level of safety calculated for the NAT Minimum Navigation Performance Specifications (MNPS) airspace. However, in order to contain the number of gross navigation errors, the meeting agreed on further methods of improving the standards of navigation. The meeting expressed its concern regarding the level of risk associated with vertical separation and consequently agreed on a series of actions aimed at reducing and or mitigating the risk. The most important change was the agreement to implement systematic lateral offsets. The efficiency of the NAT air navigation system and of the services

provided to airspace users were revisited, and it was agreed that a new method of measuring efficiency, which would take into account the key performance indicators, should be developed in coordination with similar work being carried out in other fora. With respect to technological developments, the meeting considered questions relating to the use of FANS-1/A avionics and the benefits that could be achieved as a result of the decreased requirement for HF communications.

2. Information on other major implementation activities

High frequency data link (HFDL)

2.1 Fourteen ground stations have already been implemented by ARINC Inc. at geographically diverse locations worldwide which transmit on 30 active frequencies and provide near-global coverage. Installation of additional ground systems has begun. The service is initially intended for aeronautical operational control (AOC) but a number of ATS providers (in Canada, Portugal and the United Kingdom) have started pre-operational trials of the link for air traffic service (ATS) communications (initially for way-point position reporting).

VDL Mode 2

2.2 The first implementation of VDL Mode 2, in support of controller-pilot data link communications (CPDLC) and in an ATN environment, was completed at Miami Air Route Traffic Control Centre (ARTCC) in October 2002. The programme, which was called "CPDLC Build 1" involved thirteen VDL Mode 2 ground stations and a number of suitably equipped aircraft (the number is presently around 30 and is growing). CPDLC has been an operational success in Miami. As an example, the use of data link for routine communications (employing four services, namely "Transfer of Communications", "Initial Contact", "Altimeter Setting" and "Informational Menu Text") has resulted in around 20 hours of savings in the voice channel occupancy time until August 2003.

2.3 Despite the operational success, due to mostly economic considerations, the expansion of the CPDLC programme has been deferred. Factors like uncertainties surrounding airline equipage, cost-benefit analysis and resumption of normal traffic level as well as competing projects have contributed to the decision to defer the expansion. Nevertheless, the Miami CPDLC operation will continue and will be used to help build a better business case for fleet equipage and so on. The projected national deployment of CPDLC over VDL Mode 2/ATN is now expected to occur in 2009.

2.4 As part of the LINK 2000+ programme of EUROCONTROL, CPDLC (over VDL Mode 2 and ATN) is being implemented to supplement air-ground voice communications in Europe. Nine ground stations have already been installed to provide coverage for the Maastricht upper area control centre (UACC) area. To encourage early airline equipage, a pioneer support scheme has been set up whereby support is being provided, in the form of upgrade funding, integration and pre-operational tests, to the first hundred aircraft. So far, forty-five aircraft have been designated to benefit from that scheme. Further incentives are also planned and work is ongoing towards setting a mandate for equipage by the end of the decade.

2.5 CPDLC operations are expected to commence at Maastricht UACC in late 2003. Other major milestones include operation at ACCs by 2005 and the availability of the service over the entire designated airspace by 2007. The main objective of the programme is enhancing ATM capacity and productivity, thus accommodating traffic growth and reducing delays.

2.6 Many report on other activities relating to tests, trials, demonstrations and implementation of various elements of CNS/ATM systems were presented to the Eleventh Air Navigation Conference.

Improvement of VHF spectrum utilization

2.7 As of March 2003, twenty-six States in Europe are implementing 8.33 kHz DSB-AM channel spacing (above FL 245) and three more will implement in 2003. This has resulted in significant frequency management benefits. Over 40 new 8.33 kHz channels are in use for en-route sectors and as a result several 25 kHz channels have been released for other ATC services. The next step in the implementation of 8.33 kHz channels will be to undertake expansion in the phases as identified below, with the understanding that individual States have the right to grant exemptions for aircraft and/or airspace volumes (in the same manner as the initial implementation of 8.33 kHz, on the basis of the requirement and/or the ability to participate):

a) Phase 1: above FL 195 in the ICAO EUR Region from 2006;

b) Phase 2: as required in particular terminal control areas (TMAs) and control zones (CTRs) where individual States have determined this to be a practical measure for alleviating VHF congestion; and

c) Phase 3: in designated controlled airspace in the ICAO EUR Region from 2009 onwards.

GNSS

2.8 First operational SBAS, namely the Wide Area Augmentation System (WAAS), was commissioned in the United States on 10 July 2003 for air navigation including lateral navigation (LNAV)/vertical navigation (VNAV) approaches with vertical guidance (APV). This initial WAAS capability also provides improved guidance to users in en route and departure phases of flight. A modernization programme for GLONASS has begun in the Russian Federation.

ATM Improvements

2.9 Substantial progress was made in all regions towards improving efficiency and capacity based on more accurate air navigation systems. A revised ATS route structure from Asia to the Middle East/Europe south of the Himalayas (EMARSSH) was implemented on 28 November 2002. RVSM will be introduced in the Middle East Region, and the Bay of Bengal within the Asia Region, on 27 November 2003. Planning is underway for the introduction of RVSM in the CAR/SAM Regions and in United States domestic airspace in January 2005.

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APPENDIX B

DEVELOPMENT STATUS OF SARPS AND GUIDANCE MATERIAL RELATED TO CNS/ATM SYSTEMS

MAIN FIELD		ELEMENTS	SARPs/PANS		GUIDANCE MATERIAL	
			TARGET COMPLETION DATE	STATUS	TARGET COMPLETION DATE	STATUS
ATM	ATM	Global air traffic management requirements	2005	Annexes 2 and 11 SARPs and PANS-ATM procedures under development.	2003	Draft global ATM operational concept finalized - 2nd edition of the Global Plan was published in 2002.
		Interoperability and functional integration of flight operations, ATS, ATFM and tactical ASM	2005	Annexes 2 and 11 SARPs and PANS-ATM procedures under development.	2003	Draft global ATM operational concept finalized - Further refinement to take place in 2003.
		Required total system performance (RTSP)	2005	Draft policy statement under development.	2003	Definition developed - Role and functionality of RTSP being explored as part of work on the global ATM operational concept.
		ATM requirements for communications, navigation and surveillance	2004	Annexes 2, 6 and 11 SARPs and PANS-ATM procedures under development.	2003	Additional guidance material for the *Manual of Air Traffic Services Data Link Applications* (Doc 9694) under development.
	ASM	Airspace infrastructure planning	—	—	2005	*Manual on Airspace Planning Methodology for the Determination of Separation Minima* (Doc 9689) published. Further guidance material under development by SASP and ATMCP
		RNP and RNAV for en-route operations	Completed	Annex 11 SARPs and PANS-ATM procedures adopted by Council in 1998.	Completed	Update of the *Manual on Required Navigation Performance (RNP)* (Doc 9613) completed. Second edition published.

MAIN FIELD		ELEMENTS	SARPs/PANS		GUIDANCE MATERIAL	
			TARGET COMPLETION DATE	STATUS	TARGET COMPLETION DATE	STATUS
ATM	ATS	Separation between aircraft	2005	PANS-ATM procedures approved by Council in 1998; further amendment to Annexes 2, 6, 11 and PANS-ATM under development.	2003	Amendment to the *Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum between FL 290 and FL 410* (Doc 9574) completed. Additional guidance is under development for the Manual on Airspace Planning Methodology (APM) (Doc 9689).
		ATS (uplink of MET data)	2004	Annex 3 SARPs and PANS-ATM procedures concerning D-VOLMET have been developed with the assistance of the METLINKSG.	2005	*Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services* (Doc 9377) to be amended to include the subject guidance material.
		ATS (uplink of SIGMET information in graphical format)	2004	Initial Annex 3 SARPs for graphical SIGMETs have been developed with the assistance of the METLINKSG.	2005	*Manual of Aeronautical Meteorological Practice* (Doc 8896) to be amended to include the subject of guidance material.
		WAFS planning and implementation (final phase)	2004	Annex 3 SARPs for global WAFS SIGWX forecasts in binary format (BUFR code) for direct transmission to airline and ATM computers have been developed with the assistance of WAFSSG.	2005	*Manual of Aeronautical Meteorological Practice* (Doc 8896) to be amended to include the subject guidance material.
		ATS applications for air-ground data links	2005	Annex 11 SARPs and PANS-ATM procedures are being developed.	Completed	The *Manual of Air Traffic Services Data Link Applications* (Doc 9694) published and dispatched in second quarter 1999. Additional guidance is under development.
		Data interchange between automated ATS systems	2004	Annex 11 SARPs and PANS-ATM procedures under development.	—	—

MAIN FIELD	ELEMENTS	SARPs/PANS		GUIDANCE MATERIAL	
		TARGET COMPLETION DATE	STATUS	TARGET COMPLETION DATE	STATUS
ATFM	ATFM systems and procedures	2005	Annexes 2 and 11 SARPs and PANS-ATM procedures to be developed.	2003	ATFM part of the ATM operational concept under development.
CNS/ATM	Human Factors	Completed	HF-related SARPs were developed and incorporated in Annexes 10 and 11. Further, HF-related requirements for inclusion in the PANS-OPS were developed during 2000, with an applicability date of 1 November 2001.	Completed	A manual on Human Factors Guidelines for Air Traffic Management Systems (Doc 9758) was completed and published in 2000.
	Human Resource Planning and Training	—	—	2003	The human resource planning guidance material is under development. A potential approach and format for regional training planning was developed.
COM	VHF digital link (Modes 3 and 4)	Completed	Completed in 2001. Assessment of the potential use of VDL Mode 4 for communications initiated.	2003	SARPs adopted in 2001. Manual on VDL Mode 3 technical details and implementation aspects published in 2002. Manual on VDL Mode 4 will be published by the end of 2003.
	UAT	2007	Draft SARPs are under development	2007	Manual on UAT under development

MAIN FIELD	ELEMENTS	SARPS/PANS		GUIDANCE MATERIAL	
		TARGET COMPLETION DATE	STATUS	TARGET COMPLETION DATE	STATUS
	ATN	Completed	Completed in 2001	2004	The second edition of Doc 9739 - *Comprehensive ATN Manual* has been finalized and is being processed for publication.
NAV	RNP (en-route)	Completed	Adopted/approved by Council in 1994 (Annexes 2, 4, 6, 11, 15 and PANS-ATM).	2004	Second edition of Doc 9613, *Manual on Required Navigation Performance (RNP)* was published in 1999. Additional guidance material on approval of aircraft and operations for RNP 10 was published in 2001. Similar guidance material for RNP 4 is under development.
	WGS-84	Completed	Adopted by Council in 1994, 1995, 1997 and 1998. Annexes 4, 11, 14 (both volumes) and 15 updated, provisions applicable from 1 January 1998.	Completed	*WGS-84 Manual* (Doc 9674) Second edition, which was published in 2002, included provisions relating to taxiway and apron surveying points. ICAO WGS-84 website is under development.
		2004	1. Updating of WGS-84 (as the horizontal reference system) to include temporal changes in the tectonic plate motion required for precise geodetic and some air navigation applications. 2. Introduction into Annex 15 of the vertical reference system for international civil aviation and consequential amendments to Annexes 4, 11 and 14 (both volumes) 3. Introduction into Annex 15 of the temporal reference system for international civil aviation	2005	Amendment to the *World Geodetic System — 1984 (WGS-84) Manual* (Doc 9674) to reflect the changes resulting from the latest proposed amendment to Annex 15, specifically from the proposed common reference systems for air navigation.

MAIN FIELD	ELEMENTS	SARPS/PANS		GUIDANCE MATERIAL	
		TARGET COMPLETION DATE	STATUS	TARGET COMPLETION DATE	STATUS
	Aeronautical data bases	2005	The Secretariat with the assistance of The East Tennessee State University (ETSU) developed an aeronautical communication transfer protocol for the exchange of aeronautical information/data and a new concept for computerized AIS systems.	2006	To be developed by the Secretariat with the assistance of AISMAPSG and ADMSG.
NAV (cont'd)		2006	Initial SARPs for electronic aeronautical charts for cockpit display were incorporated by Amendment 52 to Annex 4 in 2002. Further SARPs for Annex 4 under development.	2006	Under development by the Secretariat with the assistance of AISPMAPSG.
		2005	SARPs for the electronic terrain data format and exchange are under development in consultation with RTCA/EUROCAE and ISO Technical Committee 211. An interim amendment to Annex 4 planned for applicability in 2004.	2006	To be developed by the Secretariat.
	GNSS performance criteria to support operational requirements	2001	Completed	2002	Completed.
	GNSS performance criteria to support advance operations (CAT II/III, A-SMGCS and curved approaches)	2005/2007	Under development	2005/2007	To be developed in parallel with SARPs.
	SARPs for the use of existing satellite navigation systems with augmentation sub-systems	2001	Completed	2003	Completed. To be published in the form of a manual.
	SARPs for new GNSS elements and signals	2007	Work on the develoment of SARPs for new elements of GNSS (GPS second civil frequency, Galileo, GLONASS-M) is under way.	2007	Under development

MAIN FIELD	ELEMENTS	SARPs/PANS		GUIDANCE MATERIAL	
		TARGET COMPLETION DATE	STATUS	TARGET COMPLETION DATE	STATUS
SUR	Surveillance system specifications for emerging surveillance systems and architectures	2004	Surveillance enhancements (ANC Task No. CNS-9601) being developed by SCRSP.	2004	A draft circular on ASAS completed.
	SSR procedures	Completed	Update of Annex 11 and PANS-ATM.	Completed	
	ADS procedures	2004	Annex 11 SARPs and PANS-ATM procedures developed by the OPLINKP and SASP. Applicable in November 2002.	2003	*Manual of ATS Data Link Applications* (Doc 9694) published and dispatched in second quarter 1999. The first amendment is being developed.
	ADS-B and equivalent	2005	Being developed by OPLINKP	2005	Amendment to the *Manual of ATS Data Link Applications* (Doc 9694) to be developed.
	ADS: inclusion of turbulence reporting	completed	Annex 3 SARPs and PANS-ATM turbulence reporting procedures based on the eddy dissipation rate have been developed with the assistance of METLINKSG.	—	—

LEGEND

ATM — Air traffic management
ADS — Automatic dependent surveillance
ADS-B — ADS broadcast
AIS — Aeronautical information services
ASM — Airspace management
ATFM — Air traffic flow management
ATN — Aeronautical telecommunication network
ATS — Air traffic services
CNS — Communications, navigation, and surveillance
COM — Communications
GNSS — Global navigation satellite system
NAV — Navigation
RNAV — Area navigation
RNP — Required navigation performance
SSR — Secondary surveillance radar
SUR — Surveillance
UAT — Universal access transceiver
WAFS — World area forecast system
WGS — World geodetic system

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APPENDIX C

PANELS AND STUDY GROUPS INVOLVED IN CNS/ATM-RELATED ACTIVITIES

PANEL/STUDY GROUP	WORK PROGRAMME			
	TASKS	TITLE	TARGET COMPLETION DATE	STATUS /RECENT PROGRESS
OPLINKP	ATM-9102	ATS applications for air-ground data links	2004 and beyond	Work continued on draft SARPs, procedures and guidance material relating to the use of ADS, CPDLC and other data link applications.
	ATM-9502	ATM requirements for communication	On-going	The development of the concept of required communication performance (RCP) was completed and distributed to States and international organizations for comments.
	ATM-9506	Automatic dependent surveillance (ADS) systems and procedures	2004	
	ATM-9103	Data interchange between automated ATS systems	2003	Provisions applicable to air traffic services interfacility data communications (AIDC) are being developed.
	ATM-0002	ADS-B, Traffic situational awareness and airborne separation assurance	On-going	Development commenced on an operational concept and operational requirements for the use of a system to increase aircraft situational awareness and airborne separation assurance are being developed.
ACP (formerly AMCP)	CNS-7002	Aeronautical electromagnetic spectrum	On-going task	Work on development and support of ICAO position for WRC-2003 completed.
	CNS-8702	Aeronautical mobile satellite air-ground data link (AMSS subnetwork)	2004	Restructuring of the AMSS SARPs (separation of core from detailed technical specifications) has been initiated.
	CNS-9902	Next-generation AMSS systems	2004	Draft NGSS SARPs to be consolidated with restructured AMSS SARPs.
	CNS-9102	VHF air-ground digital link (VDL subnetwork)	2004	Validation of the detailed technical specification for VDL Modes 3 and 4 completed. An assessment of the use of VDL Mode 4 for communications was completed.
	CNS-9603	Air-ground data link to support navigation and surveillance applications	2004	Validation of the VDL Modes 3 and 4 SARPs completed. Development of draft UAT SARPs initiated.
	CNS-9602	High frequency data link (HFDL)	2004	Validation of detailed technical specifications ongoing.

PANEL/STUDY GROUP	WORK PROGRAMME			
	TASKS	TITLE	TARGET COMPLETION DATE	STATUS /RECENT PROGRESS
ATMCP	ATM-9501	Required total system performance	2002	The first draft of an operational concept document was finalized at ATMCP/1 in March 2002.
	ATM-9202	Global air traffic management	2002 and beyond	
	ATM-9510	Interoperability and functional integration of flight operations, ATS, ATFM and tactical ASM	2002	
ATNP (Disbanded in 2003. Outstanding work is being conducted by the ACP)	CNS-7001	AFS systems planning studies	Completed	SARPs completed. Guidance material being processed for publication.
	CNS-9403	Aeronautical telecommunication network (ATN)	Completed	SARPs for ATN have been completed and incorporated in Annex 10. Current work involves the development of provisions to incorporate Internet Protocol (IP) networks in the ATN and the development of optional message encryption provisions.
	CNS-9901	AFS procedures	Completed	Completed. Further work may become necessary as implementation of new AFS systems progress.
NSP (formerly GNSSP)	CNS-9401	Global navigation satellite system (GNSS)	Completed	First set of SARPs was adopted and included in Annex 10, Volume I as part of Amendment 76 in 2001. Further enhancements to SARPs were incorporated in Annex 10 as parts of Amendments 77 and 79 (the latter is under development). SARPs and guidance material for new GNSS elements are currently being developed.
	CNS-7002	Aeronautical electromagnetic spectrum	Ongoing task (in coordination with AMCP)	

PANEL/STUDY GROUP	WORK PROGRAMME			
	TASKS	TITLE	TARGET COMPLETION DATE	STATUS /RECENT PROGRESS
OCP	OPS-8502	Development of procedures, areas and obstacle clearance criteria for the approach, holding and departure phases of flight for inclusion in PANS-OPS, Volumes I and II	2005-2007	Several issues related to GNSS-based procedures are being investigated. Development of procedures for APV, RNP performance levels less than 0.3 and enhanced DME/DME criteria is being progressed.
	OPS-9802	Development of material for inclusion in PANS-OPS on instrument procedure data base integrity requirements	2005	A quality assurance working group has been established and will study a quality assurance requirements in the development of flight procedures to ensure data integrity.
	OPS-9803	Development of obstacle clearance criteria for vertical navigation in all phases of approach procedures	2005	Initial proposals to be available by November 2003.
	OPS-0201	Development of instrument procedures for helicopter operations at heliports	2005 and beyond	Point in space procedures have been completed and other instrument procedures are being developed. Relevant provisions of Annex 14 (relating to surfaces) are being reviewed. Initial proposals to be available in November 2003.

PANEL/STUDY GROUP	WORK PROGRAMME			
	TASKS	TITLE	TARGET COMPLETION DATE	STATUS /RECENT PROGRESS
SASP	ATM-8505	Required navigation performance and area navigation for en-route operations	2003	SARPs completed. Second edition of Doc 9613, Manual on Required Navigation Performance (RNP) published in 1999. Additional guidance material on approval of aircraft and operators for RNP 10 published in 2001. Similar guidance material for RNP 4 under development.
	ATM-6301	Separation between aircraft	2004 and beyond	Developments of proposals were advanced for the amendment of SARPs and PANS concerning reduced separation minima including: lateral distance-based intersecting track separation; 30 NM oceanic lateral and longitudinal minima based on RNP 4 submitted for publication. Procedures for RNP 4 under development. The implementation of RVSM is continuing to be under review and the revision to the *Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive* (Doc 9574) is completed.
	ATM-9505	Airspace infrastructure planning	Completed	
SCRSP	CNS-7901	Conflict resolution and collision avoidance systems	2004	Work is concentrating on surveillance enhancements and ADS-B while monitoring ACAS and Mode S implementation in the States. Activities on ASAS are progressing with the preparation of technical requirements for ASAS to be presented at SCRSP/1.
	CNS-9601	Surveillance enhancements (emerging surveillance systems)	2004	A draft ASAS circular has been developed.
	CNS-9701	Airborne separation assurance system (ASAS)	2004	
ADMSG	AIS-9401	Aeronautical data bases	2005	The Secretariat with the assistance of the East Tennessee State University (ETSU) developed an aeronautical communication transfer protocol for the exchange of aeronautical information/data and a prototype of the Computerized Aeronautical Information Services (CAIS) system. Progress on the subject by EURCONTROL/FAA is being monitored. ADMSG to be re-activated to consider latest developments including those arising from the Eleventh Air Navigation Conference.
	AIS-9806	Transfer and access of aeronautical information from ground-based automated systems.	2005	

PANEL/STUDY GROUP	WORK PROGRAMME			
	TASKS	TITLE	TARGET COMPLETION DATE	STATUS /RECENT PROGRESS
AISMAPSG	AIS-9801	Electronic aeronautical charts for cockpit display	2006	Amendment 52 to Annex 4 contained an interim amendment, applicable in 2002, concerning electronic charts for cockpit display. Further work is being progressed in consultation with the SAE G-10 Aerospace Behavioural Engineering Technology Committee, Aeronautical Charting Subcommittee. With regard to electronic terrain data, a proposal for the amendment of Annex 15 and consequential amendments to Annexes 4, 11 and 14, Volumes I and II was circulated for comment and is planned for adoption in 2004.
	AIS-9802	Electronic terrain data	2005	
AUPISG	CNS-0301	Aviation use of the public Internet	2004	Guidelines on the use of the public Internet to be developed.
AVSSSG (Disbanded in 2003. Work is being conducted by the ACP)	CNS-7001	AFS systems planning studies	Completed	The Manual on ATS ground-ground voice communications was published in 2003.
HFSG	PEL-9001	Flight safety and human factors	Completed	Review of SARPs on CNS/ATM, to ensure that Human Factors are properly taken into consideration. SARPs submitted to the Council during the periodic cycles of revision of the relevant Annexes.
HRPTSG	PEL-9601	Regional human resource planning and training needs	Completed	A draft of the Human Resource Development Manual is complete. A Human Resource Planning Seminar was developed and conducted for the first time in the CAR/SAM Regions.
METLINKSG	MET-9101	Amendment to Annex 3 concerning automated air-reporting	On-going	The quality assurance of MET information included in ADS reports being studied. The need for the inclusion of additional MET parameters (e.g. icing) in the MET information data block of the ADS report format is being addressed in coordination with the OPLINKP.
	MET-9301	Uplink of OPMET information to aircraft in flight	2004	Amendment 73 to Annex 3 has been developed which includes meteorological specifications (templates) for D-VOLMET, and other data link applications.
	MET-9601	Development of SIGMET information	2004	Amendment 73 has been developed which includes specifications for the dissemination and uplink of graphical SIGMETs.

PANEL/STUDY GROUP	WORK PROGRAMME			
	TASKS	TITLE	TARGET COMPLETION DATE	STATUS /RECENT PROGRESS
TRNSG	CNS-9402	Testing of radio navigation aids	Completed	The study group produced a new version of Doc 8071, Volume I, *Manual on testing of ground-based radio navigation systems* (replacing former Volumes I and II). TRNSG/3, 4 and 5 produced Volume II (GNSS) containing guidance material on testing of GNSS-based non-precision approaches, SBAS and GBAS.
	CNS-9401	Global navigation satellite system (GNSS)	Completed	
WAFSOPSG	MET-8802	WAFS planning and implementation	2004	Amendment 73 to Annex 3 has been developed to include global WAFS SIGWX forecasts in binary format (BUFR) code for direct transmission to airline and ATM computers.

LEGEND

ACP — Aeronautical Communications Panel
ATMCP — Air Traffic Management Operational Concept Panel
*ATNP — Aeronautical Telecommunication Network Panel
**GNSSP — Global Navigation Satellite System Panel
NSP — Navigation Systems Panel
OCP — Obstacle Clearance Panel
OPLINKP — Operational Data Link Panel
SASP — Separation and Airspace Safety Panel
SCRSP — Surveillance and Conflict Resolution Systems Panel (Former SICASP)

ADMSG — Aeronautical Data Modelling Study Group
AISMAPSG — Aeronautical Information and Charts Study Group
AUPISG — Aviation Use of the Public Internet Study Group
*AVSSSG — ATS Voice Switching and Signalling Study Group
HFSG — Flight Safety and Human Factors Study Group
HRPTSG — Human Resource Planning and Training Study Group
METLINKSG — Meteorological Information Data Link Study Group
***TRNSG — Testing of Radio Navaids Study Group
WAFSOPSG — World Area Forecast System Operations Group

*Disbanded in 2003 — outstanding work to be carried out by the ACP
**Renamed NSP in 2003
***Disbanded in 2003 — outstanding work to be carried out by the NSP

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APPENDIX D

COMPARATIVE ANALYSIS OF REGIONAL DEVELOPMENTS IN AIR NAVIGATION SYSTEMS

AIR TRAFFIC MANAGEMENT								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	Revision of ATS route structure	South China Sea - implemented on 1 November 2001. Asia to Europe through Middle East via south of Himalayas implemented on 28 November 2002. (EMARSSH)	Established new ATS routes.	Asia to Europe through Middle East via south of Himalayas implemented on - 28 November 2002. (EMARSSH) Revision of route structure in Eastern and Western part of Europe - On going.	The development of a new ATS RNAV route network in CAR/SAM Regions - In progress.	Asia to Europe through Middle East via south of Himalayas implemented on 28 November 2002. (EMARSSH) New Middle East ATS route network - 22 December 2003.	The ATS route structure of the NAM Region is pending to be included in an updated version of the NAM ANP.	-
2	RVSM	Pacific airspace- implemented on 24 February 2000. Western Pacific airspace implemented on 21 February 2002. Hong Kong FIR and Sanya AOR implemented on 31 October 2002. Bay of Bengal and beyond - 27 November 2003.	Implementation strategy and action plan under consideration. Target date to be determined. Parts of Region falling in SAM and EUR corridor - implemented on 24 January 2002.	Western part of European Region - Implemented on 24 January 2002. Planning for expansion in Eastern part of the Region has commenced. EUR/SAM Corridor - 24 January 2002	EUR/SAM corridor - 24 January 2002. CAR/SAM Regions - 20 January 2005	Middle East Region - 27 November 2003.	Canada implemented RVSM between FL 290 to FL 410 inclusive in Northern domestic airspace (north of 57N) and transition airspace (between 52N and 57N) on 18 April 2002. United States is to implement RVSM in the domestic airspace from FL 290 to FL 410 - 20 January 2005.	Horizontal RVSM expansion in the entire NAT Region from FL 310 to FL 390 completed on 1 November 2001. Vertical expansion of RVSM throughout NAT Region from FL 290 to FL 410 - implemented on 24 January 2002.

N.B. Historical data, wherever possible, has been indicated in *italics*.

AIR TRAFFIC MANAGEMENT								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
3	Establishment of regional airspace safety system performance monitoring structure.	Regional Airspace Monitoring Advisory Group was established by APANPIRG/14 in August 2003.	Under consideration.	Implemented - Financial mechanism being developed.	Brazil has been designated as monitoring agency for CAR/SAM regions for implementation of RVSM.	Middle East Central Monitoring Agency (MECMA) operated by UAE has been designated to monitorr RVSM and RNP/RNAV	Canada will implement in the designated RVSM airspace.	Implemented.
4	ACAS II	*Mandated from 23 March 2000.*	*Mandated from 1 January **2003**.*	*Mandated from 1 January 2000.*	Mandated from 1 January 2003.	*Mandated from 1 July2001.*	Implemented in Canada and the United States airspace.	*Mandated from 31 March 2001.*
5	RNAV/RNP	RNP 10: 1) North Pacific and Tasman - 23 April 1998; 2) South China Sea - 1 November 2001; 3) Australia and Indonesia - 1 November 2001; 4) Bay of Bengal - November 2002. Other routes under consideration RNP 4 under development in the South Pacific area other routes under consideration	RNP5 - implemented in continental Johannesburg FIR in 1998. RNP10- implemented in Mauritius on 5 March 2003. For other routes - Under consideration.	RNAV/RNP5 implemented in ECAC area from January 1998. Implementation of precision RNAV (nearly equivalent to RNP 1) in terminal areas is planned for 2004.	EUR/SAM corridor RNP10 - implemented on 4 October 2001; Pre-operational implementation of RNP10 for routes UL302 and UL780 approved. For other routes - Under consideration.	RNP 5 Phase 1 Implemented - 14 June 2001. RNP5/RNAV Phase 2 implementation started with effect from 28 November 2002 as an ongoing process.	United States has implemented RNP in domestic and oceanic airspace since 1998. Canada is planning to implement RNP in domestic airspace in 2006. RNAV route structure in the NAM Region is under review.	MNPS implemented in 1981.

N.B. Historical data, wherever possible, has been indicated in *italics*.

COMMUNICATIONS								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	ATN (Subnetworks, End systems and Intermediate systems)	ATN transition plan has been developed with a target date of 2005 for ground - ground application namely ATN router and AMHS. AMHS tests are progressing. To ensure harmonization and to facilitate implementation several interface control documents (ICDs) have been developed.	ATN implementation is Under study. Focus is more on improving current circuits with long term plans for migrating to AMHS and AIDC.	ATN transition plan is being developed. Pre-operational trials are in progress. The Link 2000 programme will gradually introduce operational applications over A-G ATN on VDL2 from 2003 to 2010.	ATN initial transition plan is under review. With the REDDIG implementation (SAM Digital Network) in 2003, AMHS and AIDC implementations would be facilitated.	Current AFTN circuits are being improved for transition to ATN. Guiding principles have been prepared for ground-ground application namely AMHS and AIDC	ATN transition plan has been developed with focus on ground-ground applications. Test, development and validation phases completed. Operational implementation is under review.	Investigation of operational ATN data link scenarios in the Region with focus on air-ground applications is in progress.

N.B. Historical data, wherever possible, has been indicated in *italics*.

COMMUNICATIONS								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
2	Air-ground communication infrastructure	Further improvements are made in VHF voice in continental and terminal areas. VHF data link is used for D-ATIS, D-VOLMET and CPDLC	VHF Voice is provided in terminal areas.	Implementation of air-ground data link services is planned for 2002-2007.	VHF voice is provided in continental and terminal areas. HF voice is provide in oceanic areas.	VHF voice is provided in continental and terminal areas. VHF data being studied.	There are plans for AMSS for voice and ATN-compatible sub-networks such as VDL Mode 2, HFDL and AMSS to support CPDLC applications.	HF is the main communication and already saturated with difficulty of obtaining additional frequencies.
		AMSS data (for ADS and CPDLC using FANS-1/A) is used in oceanic and remote areas and AMSS voice is used for non-routine and emergency communications.	Extension of VHF coverage to en route areas is in progress in several FIRs.	Horizontal expansion of 8.33 kHz channel spacing from 7 to 29 States implemented on 31 October 2002.	Implementation of VDL Mode 2 to support CPDLC and D-ATIS is under study.	AMSS for data and Voice in oceanic and remote areas are used.		Trials to use CPDLC based on FANS-1/A for routine communications are being carried out.
		SSR Mode S data link for high density airspace are being planned.	HF Voice is provided in most of FIRs. CPDLC based on FANS-1/A is being used.	Vertical expansion of 8.33 kHz channel spacing. from FL 245 to FL 195 planned for 2006.	Tests on HFDL are being conducted.	SSR Mode S data link for high density airspace is being considered.		AMSS application is being assessed.

N.B. Historical data, wherever possible, has been indicated in *italics*.

COMMUNICATIONS								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
3	Ground-ground communication infrastructure	Some of the States have implemented digital networks. AFTN based AIDC procedure is implemented by some States. Interface Control Document (ICD) for AIDC Version 2 was adopted by APANPIRG/14 Other States are also considering upgrading their networks.	Three major satellite networks have been provided in the States of the Region: namely AFISNET,, SADC and CAFSAT). Another satellite network (NAFISAT) is being developed for AFI North East region. Consolidation of these networks is under consideration	Well developed. Many of the States have upgraded to digital networks.	Number of digital networks have been implemented in the Region. Interconnection of theses networks so as to provide interoperability is in progress.	Establishment of a regional satellite based digital network is under consideration. Feasibility study completed. and report submitted to MIDANPIRG/8 in September 2003.	Well developed. Canada, Mexico and United States have upgraded to digital networks.	Well developed. Many of the States have upgraded to digital networks.

N.B. Historical data, wherever possible, has been indicated in *italics*.

NAVIGATION								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	GNSS	Transition to WGS-84 is in progress. Strategy for implementation of GNSS was updated and adopted. A check list to assist GNSS implementation developed by APANPIRG is used by States for implementation. Satellite based augmentation system (MSAS) is being developed. with a target date of commissioning with one satellite in 2004 and two satellites in 2006. GNSS is used for oceanic and remote continental areas for en- route operations and NPA as supplemental means.	Transition to WGS-84 is in progress. GNSS strategy has been adopted. Development of harmonized GNSS/NPA procedures for States of SADC completed in December 2001, and for ASECNA States in 2002. Plans for other FIRs scheduled in 2003 and 2004. SBAS test bed in cooperation with EGNOS is being implemented. GNSS is being used for oceanic and continental en- route operations.	Transition to WGS-84 is on-going. Launching of "Galileo", a new constellation of navigation satellites was decided by the European Council on 26 March 2002 with full operation capability slated for 2008. Satellite based augmentation system (EGNOS) is being developed with a target date of commissioning in 2005. GNSS is being used for continental en route operations.	Considerable progress has been achieved in the SAM Region and efforts continue in the CAR Region for implementation of WGS-84. SBAS test bed project in cooperation with WAAS is being developed. A ionospheric model is under study in order to apply the NPA Operation with SBAS Test Bed. SBAS test bed in cooperation with EGNOS is also being developed GNSS is being used for oceanic and continental en route operations	Transition to WGS-84 is in progress. Strategy for implementation of GNSS is being developed. SBAS test bed in cooperation with EGNOS was carried out. GNSS is being used on supplemental and primary means for navigation for enroute and NPA.	Transition to WGS-84 completed in Canada and United States. In Mexico, it is in progress. The GNSS/GPS strategy has been adopted. SBAS based on the United States' wide area augmentation system (WAAS) was commissioned on 10 July 2003 for initial operating capability A GNSS approach implementation programme has been initiated by all three States and GNSS augmentation system agreements have been completed for the future expansion of the GNSS concept. GNSS is being used for oceanic and continental en-route operations	Transition to WGS-84 completed. GNSS is being used for oceanic operations.

N.B. Historical data, wherever possible, has been indicated in *italics*.

SURVEILLANCE								
No	System	ASIA/PAC	AFI	EUR	CAR/SAM	MID	NAM	NAT
1	SSR Modes A/C and SSR Mode S	Currently SSR Modes A/C is employed. SSR Mode S being implemented in some terminal areas and high density en route.	Surveillance in most FIRs is through pilot voice position reporting. PSR and SSR Mode A/C are employed in some busy terminals and for en-route operations. An en-route aeronautical surveillance plan with SSR requirements included in the AFI FASID.	Currently SSR Modes A/C is employed. The ORCAM code management has been extended to the whole Region. SSR Mode S in some terminal areas and high density en route is planned for implementation: - basic Mode S in 2003 to 2005, - enhanced Mode S 2005 to 2007.	Currently SSR Modes A/C is employed. Use of ASTERIX protocol for SSR data sharing was established. In the near future SSR Mode S in some terminal areas and high density en route will be planned.	The Region is well covered by radars (PSR/SSR Mode A/C). SSR Mode S is planned for some terminal and high density en route areas in 2006.	En-route radar surveillance has seen substantial improvements with the upgrading of radar systems in a large part of the airspace. In several areas of the Gulf of Mexico and Northern Canada, surveillance has been restricted to position reports sent by pilots via air-ground communications. A plan to improve radar surveillance in the Gulf of Mexico is being developed.	Surveillance in most of the NAT Region is via position reports using HF Voice at approximately every 10 degrees of longitude. ADS and other data link technologies are being used for Waypoint Position Reporting
2	ADS	FANS-1/A based ADS-C is used initially for oceanic airspace and in remote areas. ADS/CPDLC services (using FANS-1/A) are operational in the PAC Region. Operational trials are being established for Southeast and West Asian Region	ADS will be used for low density, remote and oceanic airspace as well as outside SSR coverage.	ADS will be used in some parts of the Region.	ADS will be used initially for oceanic airspace and later in remote areas.	ADS will be used initially for oceanic airspace and later in remote areas and possibly as a backup to SSR in high density traffic areas in 2005.	ADS will be used in oceanic or remote areas; however, further review is needed for continental domestic airspace areas.	To improve surveillance, the regional plan specifies ADS over the ATN. Nevertheless, provisions have been made to accommodate FANS-1/A equipped aircraft.

N.B. Historical data, wherever possible, has been indicated in *italics*.

SURVEILLANCE								
No	System	ASIA/PAC	AFI	EUR	CAR/SAM	MID	NAM	NAT
3	ADS-B	ADS-B trials are in progress in Australia, Japan and Mongolia. "ADS-B out" for ground based surveillance is expected to be implemented on a sub-regional basis from Jan 2006	To be determined.	To be determined. Mode S squitter related applications from 2007.	To be determined.	To be determined.	ADS-B trials are in progress in Canada and United States. The Alaska Capstone programme (using UAT) continued and so far 190 aircraft have been suitably equipped, ten ground transceivers have been installed and one tower display showing ADS-B targets is in operation.	To be determined

RELATED ISSUES								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	Transition from current single volume ANP to two volumes Basic ANP and FASID documents	Material finalized. Document in final preparation stage for publication. Amendments continue to be processed for both ANP and FASID	Material finalized and published.	Material finalized and published. Documents are being kept up to date.	Material finalized and published. Documents are being kept up to date.	Material finalized and awaiting publication.	A revision programme was proposed to update the FASID document.	The trial NAT Basic ANP and FASID are being reviewed and is scheduled to be completed by early 2004.
2	Development and update of Regional plan for CNS/ATM systems	Reviewed and updated. **A** new chapter on the subject of meteorology **was included**.	Reviewed and updated.	Reviewed and updated.	Under review to update the Plan.	Reviewed and updated.	Reviewed and updated.	New plan being developed.

N.B. Historical data, wherever possible, has been indicated in *italics*.

RELATED ISSUES								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
3	Interregional groups which coordinate and ensure seamlessness in the implementation of Air Navigation Systems between the Regions	South-West Asia ATS Coordination Group (SWACG). Indian Ocean ATS Co-ordination Group (IOACG). Europe/Asia Air Routes Meeting (EAAR). ICAO Meetings for the Planning and Coordination of Implementation of ATS Routes through the airspace of the Eastern Part of the ICAO EUR Region, including Middle Asia (TARTAR). Informal Trans-Asia, Trans-Siberia and Cross-Polar Routes Steering Group (ITAPS).	I Indian Ocean ATS Co-ordination Group (IOACG). Informal interface meetings between EUR/MID and EUR/AFI are convened from time to time. South Atlantic Coordination Group (SAT).	South-West Asia ATS Coordination Group (SWACG). Europe/Asia Air Routes Meeting (EAAR). Informal interface meetings between EUR/MID and EUR/AFI are convened from time to time. South Atlantic Coordination Group (SAT). ICAO Meetings for the Planning and Coordination of Implementation of ATS Routes through the airspace of the Eastern Part of the ICAO EUR Region, including Middle Asia (TARTAR). Informal Trans-Asia, Trans-Siberia and Cross-Polar Routes Steering Group (ITAPS).	East CAR and North and North East SAM Implementation and Coordination Group (ECAR/NESAM ICG) CANADA/MEXICO/ USA CNS/ATM Working Group South Atlantic Coordination Group (SAT)	South-West Asia ATS Coordination Group (SWACG). Informal interface meetings between EUR/MID and EUR/AFI are convened from time to time.	CANADA/MEXICO/ USA CNS/ATM Working Group Informal Trans-Asia, Trans-Siberia and Cross-Polar Routes Steering Group (ITAPS).	-

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RELATED ISSUES								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
4	Meteorological component of CNS/ATM systems	Migration from T4 charts to WAFS forecasts in the digital code forms (i.e. WMO BUFR and GRIB code forms) is being addressed and will be fully implemented by 1 July 2005. Workshops on the use of the GRIB and BUFR coded WAFS data have been organized by the WAFC Provider States in coordination with ICAO and WMO. The Regional Area Forecast Centres have been phased-out and their responsibilities have been transferred to the World Area Forecast Centres D-VOLMET being implemented by some States. Trials on the meteorological data downlink through ADS conducted.	Migration from T4 charts to WAFS forecasts in the digital code forms (i.e. WMO BUFR and GRIB code forms) is being addressed and will be fully implemented by 1 July 2005. Workshops on the use of the GRIB and BUFR coded WAFS data have been organized by the WAFC Provider States in coordination with ICAO and WMO. The Regional Area Forecast Centres have been phased-out and their responsibilities have been transferred to the World Area Forecast Centres	Migration from T4 charts to WAFS forecasts in the digital code forms (i.e. WMO BUFR and GRIB code forms) is being addressed and will be fully implemented by 1 July 2005. Workshops on the use of the GRIB and BUFR coded WAFS data have been organized by the WAFC Provider States in coordination with ICAO and WMO. The Regional Area Forecast Centres have been phased-out and their responsibilities have been transferred to the World Area Forecast Centres	Migration from T4 charts to WAFS forecasts in the digital code forms (i.e. WMO BUFR and GRIB code forms) is being addressed and will be fully implemented by 1 July 2005. Workshops on the use of the GRIB and BUFR coded WAFS data organized by the WAFC Provider States in coordination with ICAO and WMO will take place in December 2003 in Costa Rica The Regional Area Forecast Centres have been phased-out and their responsibilities have been transferred to the World Area Forecast Centres	Migration from T4 charts to WAFS forecasts in the digital code forms (i.e. WMO BUFR and GRIB code forms) is being addressed and will be fully implemented by 1 July 2005. Workshops on the use of the GRIB and BUFR coded WAFS data are planned to be organized by the WAFC Provider States in coordination with ICAO and WMO. The Regional Area Forecast Centres have been phased-out and their responsibilities have been transferred to the World Area Forecast Centres	Migration from T4 charts to WAFS forecasts in the digital code forms (i.e. WMO BUFR and GRIB code forms) is being addressed and will be fully implemented by 1 July 2005. Workshops on the use of the GRIB and BUFR coded WAFS data organized by the WAFC Provider States in coordination with ICAO and WMO will take place in December 2003 in Costa Rica The Regional Area Forecast Centres have been phased-out and their responsibilities have been transferred to the World Area Forecast Centres	Not applicable as this issue is being addressed by the States as part of EANPG. Not applicable. Not applicable

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RELATED ISSUES								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
5	Review of deficiencies	Addressed as part of the PIRG work programme. Dedicated TF established to develop appropriate management tools.	Addressed as part of the PIRG work programme. The list of deficiencies are grouped on the basis of States in addition to facility wise. Various COSCAPs are also addressing this issue. Establishment of an Aviation Safety Board is under consideration.	Addressed as part of the PIRG work programme. There are currently no outstanding formal deficiencies.	Addressed as a part of the GREPECAS work programme. Adopted a Regional Strategy in order to resolve all type of deficiencies in the air navigation field Established an Aviation Safety Board .	Addressed as part of the PIRG work programme. Dedicated Safety working Group was established .	-	Addressed as part of the PIRG work programme. There are currently no outstanding formal deficiencies.
6	Specific to the region	Guidance material to enhance aeronautical information services activities within the Region has been developed. AIS quality assurance manual has been developed.	The new larger aeroplane task force developed a strategy for future work including the evaluation of the impact on aerodromes of the AFI Region. Establishment of an appropriate body for addressing regional human resource and training issues is under consideration.	Focussing on increasing the efficiency and capacity at international aerodromes through the implementation of capacity enhancing procedures.	Human resources and training issues are being addressed. The development of an ATS and AIS Quality Assurance Programme and its associated activities are being carried out. Important steps have been given to advance into the implementation of the automated AIS system and in the development of National Data Banks. Most of the States have published the AIP in the new structure.	Formulation of a plan for development of regional training capabilities within specific training centres will be addressed through a dedicated task force.	-	Work has been initiated for the development of operational and economic performance indicators , which will be used throughout NAT Region.

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ORGANIZATIONAL ISSUES								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	Establishment of Sub-regional entities/groups for provision of air navigation services.	Advice provided to States about the benefits of cooperative arrangements and mechanism.	Southern Africa Development Community (SADC) Agency for the Safety of Air Navigation in Africa and Madagascar (ASECNA) Common Market for Eastern and Southern Africa (COMESA) Roberts FIR Organization (Guinea, Liberia and Sierra Leone) Accra FIR (Benin, Ghana and Togo) Study for a common upper airspace control for the East African Community (EAC) planned in 2003/2004.	Eurocontrol	Central American Corporation for Air Navigation Services (COCESNA); SAM Sub-regional Group for Digital Network (REDDIG) Eastern Caribbean Sub-Regional Group for digital network (E-CAR) Central Caribbean Sub-regional Group for digital network (MEVA)	Europe Middle East Regional Coordination Bureau on Air Traffic Management (EMAC)	Sub-regional group comprising of Canada, Mexico, United States of America (CAN/MEX/USA)	–

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ECONOMIC ISSUES								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	Cost benefit study, business case analysis and cost recovery system	Advice was provided to National Meterological Service Providers about the application of ICAO's guidance and policies on cost recovery	Business case and cost benefit analysis has been carried out for SADC States for the UACC project. Similar exercise is under consideration for areas of routing AR4 (Europe to Southern Africa). Business case and cost benefit analysis is underway for the establishment of Upper ACC for East African Community	Business case and cost benefit analysis are being carried out by Eurocontrol. No ICAO Secretariat involvement.	The Secretariat assisted in the economic aspects of the study of the transitional plan (Project RLA/98/003) to CNS/ATM systems through the development and integration of a financial module. The Secretariat also participated in the organization of a Seminar in Honduras (Oct. 2002) on the economics and institutional aspects of CNS/ATM systems. GREPECAS Task Force on Institutional Aspects for CNS/ATM implementation has been reactivated.	A business case illustrative application has been developed for the region.	Business case and cost benefit analysis are being carried out by CAN/MEX/USA. No ICAO Secretariat involvement.	The feasibility of creating a common cost-recovery system for the provision of air navigation services in the northern part of the region was considered. No changes to the current system are envisaged. Cost effectiveness of implementation of new systems are studied as an ongoing exercise through the NAT Cost Effectiveness Programme.

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TRAFFIC FORECASTS								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	Traffic Forecasting Groups (TFGs)	Traffic Forecasting Group is in existence since 1991. Eleventh meeting of TFG was held in Bangkok from 30 September to 4 October 2002. Next meeting: tentatively scheduled for 2004	Traffic Forecasting Group formed in 1998. Third meeting of TFG was held in Dakar from 24 to 26 March 2003. Next meeting: tentatively scheduled either 2004 or 2005	Data developed by Eurocontrol are being used.	Traffic Forecasting Group established in 1996. Fifth meeting of TFG was held in Lima from 5 to 9 August 2002. Next meeting tentatively scheduled for 2004	Traffic Forecasting Group (TFG) created in 1998. Integration of this TFG into MIDNAPIRG is subject to approval of the Council in C/171. The fifth meeting of the TFG was held in Cairo from 15-19 January 2002. Sixth meeting: in Cairo, 16-17 October 2003	No ICAO Secretariat involvement.	NAT Forecasting Group was established in 1965.
2	Traffic forecasts	Traffic forecasts have been developed for major route groups up to the year 2015 and updated to reflect the impact of the 11 September events.	Passenger and aircraft movement forecasts have been developed for major route groups up to the year 2018.	No ICAO Secretariat involvement. Forecasting is done by Eurocontrol.	Forecasts prepared for 6 major route groups up to the year 2012 and reviewed taking into account the impact of the 11 September events.	Forecasts of major traffic flows to, from and within the Middle East region as well as aircraft movement forecasts for the city -pairs within each major traffic flow up to the year 2015 has been developed.	No ICAO Secretariat involvement.	Traffic forecasts are developed bi-annually. They were reviewed early in 2002 to reflect the impact of the 11 September events.

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Legal Issues								
No	**System**	**ASIA/PAC**	**AFI**	**EUR**	**CAR/SAM**	**MID**	**NAM**	**NAT**
1	Addressing legal issues such as universal accessibility, continuity, certification and liability.	Legal issues have been raised but these are beyond the scope of regional bodies. HQ should continue to provide guidance and address and resolve them at global level.	The subject has not yet been examined by APIRG. We expect the HQ to adequately address this issue for the benefit of PIRGs.	Legal issues were discussed in the context of the Galileo programme.	Legal issues are beyond the resolution at the regional level. HQ must provide the leadership in this domain.	The question is too large and complex. MIDANPIRG did not look into the matter deep.	-	-
2	Development of an interim legal framework	An interim legal framework, the "Charter on the Rights and Obligations of States Relating to GNSS Services", was adopted in 1998 by the 32nd Session of the Assembly in the form of Resolution A32-19, which embodies certain fundamental principles applicable to GNSS. The ICAO headquarters is pursuing its efforts to resolve the complex legal issues involved and will continue to provide guidance at global level. The Secretariat Study Group on Legal Aspects of CNS/ATM systems is expected to finalize the concept of a contractual framework for CNS/ATM systems and provide a path toward its implementation, including the consideration of an international convention. The results of the work of the Group will be reported, through the Council, to the next ordinary session of the Assembly in 2004. The security aspects concerning prevention of unlawful interference with CNS/ATM systems will be reviewed in the context of aviation security.						

— END —

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