



**INTERNATIONAL CIVIL AVIATION ORGANIZATION
WESTERN AND CENTRAL AFRICAN OFFICE**

**FIRST MEETING OF DIRECTORS GENERAL OF CIVIL AVIATION
(Abuja, Nigeria, 19-21 March 2002)**

Agenda Item 1: Strategies for elimination of deficiencies in the Region

1.3 Communications, Navigation and Surveillance (CNS)

(Presented by the Secretariat)

SUMMARY

This paper highlights deficiencies in the fields of Communications, Navigation and Surveillance, et suggests some measures in view of their elimination.

REFERENCES

Annex 10 - *Aeronautical Telecommunication*
Doc 7030 - *Regional Supplementary Procedures*
Doc 8071 - *Manual on radio navigation aids*
Doc 7474 - *Air Navigation Plan for Africa-Indian Ocean Region (AFI)*
Doc 9705 - *Manual of technical provisions applicable to the Aeronautical Telecommunication Network (ATN)*
Doc 9750 - *Global Air Navigation Plan for CNS/ATM Systems*
Doc 003 - *AFI CNS/ATM Systems Implementation Plan*
Doc 8259 - *Manual on the Planning and Engineering of the Aeronautical Fixed Telecommunication Network*
Doc 9718 - *Handbook on Radio Frequency Spectrum requirements for Civil Aviation*
Doc 9694 - *Manual on ATS data link applications.*
Doc 9432 - *Manual of Radiotelephony*
Doc 9684 - *Manual on Secondary Surveillance Radar (SSR) Systems*
Circular - 183-AN *ATS/DS circuits - Guidelines for the Planning of a Switched Network.*
Doc 9702 - *Report of the Seventh Africa-Indian Ocean Regional Air Navigation Meeting (RAN/AFI/7)*
APIRG - *Report of the Thirteenth Meeting*

1. Introduction

1.1 International Standards and Recommended Practices on communications, navigation and surveillance are contained in Annex 10 - *Aeronautical Telecommunication* - composed of five volumes: Volume I - *Radio Navigation Aids*, Volume II - *Communication Procedures*, Volume III - *Communication Systems*, Volume IV - *Surveillance Radar and Collision Avoidance Systems*, and Volume V - *Aeronautical Radio Frequency Spectrum Utilization*. In addition to provisions in Annex 10, more specific and detailed guidance material is provided in relevant technical manuals or circulars.

2 Discussion

2.1 Deficiencies in the fields of Communications, Navigation and Surveillance in the Region.

Appendix to WP/2 contains the list of shortcomings and deficiencies reported in the Region in the fields of communications, navigation and surveillance, in respect of implementation of international standards and air navigation plan requirements. These deficiencies could be summarized as follows.

2.1.1 Communications

Aeronautical fixed services (AFS)

- implementation of the aeronautical fixed telecommunication network (AFTN) incomplete
- implementation of the air traffic services direct speech network (ATS/DS) incomplete
- low availability of existing circuits
- low-speed circuits
- inadequate message transit time
- discrepancies between sub regional satellite telecommunication networks
- analogue systems with limited processing capacity

Aeronautical mobile service (AMS)

- limited coverage of air-ground communications on very high frequency (VHF)
- assignment of VHF frequencies not compliant with the air navigation plan
- predominant use of high frequency (HF) communications, with inherent technical limitations
- misuse, interference and congestion of HF frequencies

2.1.2 Navigation

Aeronautical radio navigation service (ARNS)

- implementation incomplete
- low density of radio navigation aids, due to geographical constraints such as large desert areas or deep forests
- low availability rate of radio navigation aids
- lack of/insufficient flight checks of navigational aids
- high separation minima between aircraft
- low airspace capacity to cope with the air traffic growth
- non-direct and non-economic air routes (long flight time and high fuel consumption)

2.1.3 Surveillance

- lack or limited radar coverage in high density traffic airspace
- large use of procedural control based on pilot reports only
- approximate, inaccurate or incomplete visualization of the air situation by controllers (risk for air safety)
- high separation minima between aircraft.

2.1.4 Personnel

- inadequate staffing as far as quantity and quality are concerned
- insufficient rating on aeronautical equipment and associated techniques/technologies
- lack of, or insufficient training on new technologies (satellites, networking, digital data processing and transmission, automation, distributed systems, etc.).

2.2 Action suggested

2.2.1 Communications

The APIRG recommended that the implementation of reliable and high performance aeronautical telecommunication networks (AFTN, ATS/DS, extended VHF) be the first step towards the extension of air traffic control service in the Region (Conclusion 13/72 refers), and the introduction of more sophisticated elements of the new communications, navigation, surveillance and air traffic management (CNS/ATM) systems adopted by ICAO in 1991. The joint use of satellites, digital and data processing techniques was already identified - for more than a decade - as bearer of an effective solution to make it possible for civil aviation to have such CNS networks, and to foster the gradual introduction of the aeronautical telecommunication network (ATN) concepts and applications developed within the framework of CNS/ATM (ADS, CPDLC, DFIS, AMHS, AIDC¹) in order to cope with traffic evolution.

For that reason, ICAO advocated and co-ordinated the implementation of the first aeronautical satellite telecommunication network, encompassing eight (8) countries in Western and Central Africa (SATCOM/AFISNET²), within the framework of a regional project funded by the European Union (European Development Fund). The network has been operational for several years now and extended to other countries in the sub-region. Two other sub-regional networks were developed for Southern Africa (the SADC³ VSAT network) and South Atlantic (CAFSAT⁴ network); a fourth network - called NAFISAT⁵ - is being designed for the Northern-Eastern part of Africa (APIRG Conclusion 13/15 refers).

The interoperability of these networks, which were designed independently, is the cornerstone of an infrastructure of telecommunications commensurate with all the requirements as defined for the entire Region. The success of the common approach adopted for the initial network suggests a regional approach, under the aegis of AFCAC and ICAO, in the search for financing for the implementation of its extension in order to achieve a coordinated and integrated AFI VSAT network.

2.2.2 Navigation

The ICAO global navigation satellite system (GNSS) operates with satellite constellations having a good consolidated footprint over the Region, with augmented signals, enabling the system to meet the accuracy, integrity, availability and continuity criteria as defined for en-route, approach and landing phases of flight.

The study on the introduction of the GNSS in the Region had already been carried out by the APIRG, through partnership with the European Union, which also contributed in the organization of two workshops. The

¹ADS: Automatic Dependent Surveillance
 CPDLC: Controller-Pilot Data Link Communications
 DFIS: Data Link Flight Information Service
 AMHS: ATS Message Handling System
 AIDC: ATS Inter-facility Data Communications

² AFISNET: AFI Aeronautical Satellite Telecommunication Network

³ SADC: Southern Africa Development Community

⁴ CAFSAT: Central Atlantic FIRs Aeronautical Satellite Network

⁵ NAFISAT: Northern-Eastern AFI Aeronautical Satellite Telecommunication Network

study enabled the APIRG to adopt a regional GNSS strategy (Conclusion 13/84 refers). The strategy proposed that a pre-operational validation be performed through a European Geostationary Navigation Overlay Service-based Test Bed (EGNOS/ESTB⁶). Specifications for the EGNOS test bed have already been defined, as well as the basic infrastructure requirements (reference stations, sites arranged, high-quality energy, high-speed data transmission network, etc). However, due to lack of financing, the AFI Region has not been able to conduct the EGNOS/ESTB for the past three (3) years.

In addition, it is worth mentioning that the international community is also interested in AFI participation in the EGNOS test bed (traffic flow between Europe and Africa accounts for 75% of the continental traffic). **It is therefore suggested that a common approach be adopted under the aegis of AFCAC and ICAO**, for the mobilization of resources for the test bed, and the gradual implementation of an operational AFI GNSS system.

2.3 Surveillance

Pursuant to RAN/AFI/7 Recommendation 11/1, APIRG has already developed a surveillance plan for AFI area control centres and/or en-route flight information centres (Conclusion 13/78 refers). The surveillance plan will be completed for terminal areas. Given the wide scope of CNS requirements, and whenever arbitration is required, **a step-by-step approach suggests that priority should be accorded to communications and navigation issues.**

3. Action by the meeting

3.1 The meeting is invited to:

- Take note of the information provided in this working paper;
- Exchange views on ways and means of improving communications, navigation and surveillance facilities in the Region;
- Recommend a common regional approach in the search for necessary financing with the view to:
 - Achieving effective inter-operability between sub-regional aeronautical satellite telecommunication networks,
 - Performing the EGNOS Test Bed,
 - Implementing an operational AFI GNSS element, and
 - Establishing a training and proficiency programme for staff in sufficient number in techniques and technologies that are being utilized by modern aviation industry, based on specific requirements identified in the Region;
- Encourage continuation of co-operation agreements between States/Organizations in the Region, for operations, maintenance, calibration, exchange of personnel, approval and certification of CNS facilities, as required; and
- Request AFCAC and ICAO to propose co-operation mechanisms between States/Organizations in the Region, for operations, maintenance, calibration, exchange of personnel, approval and certification of CNS facilities, as required. /-

⁶ ESTB: EGNOS System Test Bed