



**AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP**

**THIRTEENTH MEETING (APIRG/13)**

*(Sal, Cape Verde, 25 - 29 June 2001)*

**Agenda Item 3** : Review and follow-up of APIRG/12 Conclusions and Decisions including AFI/7 RAN Meeting outstanding recommendations.

**Interconnectivity between VSAT Networks**

*(Working Paper presented by ASECNA)*

**SUMMARY**

the current working Paper gives a description of the aeronautical telecommunications networks by satellite in AFI Region and proposes a solution for their interoperability, as global ATN subnetwork.

**I - INTRODUCTION :**

According to APIRG/12 Conclusion 12/11, the entities responsible for the operation of Sub-Regional VSAT networks be urged to ensure that interconnection between networks are implemented expeditiously , so that the benefits of such networks are explored to the full and major shortcomings in the provision of Fixed . Service are eliminated.

Indeed, one of the essential components for the implementation of new CNS/ATM systems , is the future Aeronautical Telecommunications Network of ICAO: ATN

Why ATN?

- Single environment for the aeronautical digital communications
- heterogeneous subnetwork interconnection
  - mode S subnetwork,
  - satellite subnetwork,
  - VHF subnetwork
  - ground subnetwork

- avionics subnetwork
- Architecture allowing an increase in exchanged data volumes and reliability of these exchanges
- seamless telecommunications coverage
  - oceanic areas
  - desert areas

Considering the above mentioned criteria, can AFISNET, CAFSAT and SADC networks, the most representative in AFI Region, be regarded as ATN subnetwork ?

## **II – EXAMINATION OF CAFSAT, SADC AND AFISNET NETWORKS**

### **A. Networks presentation**

#### **□ AFISNET(African and Indian Ocean Satellite Network) :**

This network is implemented around two INTELSAT satellites :

1. Satellite **IS 601@ 325.5° East** for the continental subnetwork
  - Operation in IBS mode on transponder 105/105 in south-east zone beam, in B polarisation and C band
  - Operation in FASTCOM(ALCATEL) mode on transponder 20/20, in hemispheric beam , in A polarisation and in C band
  - Possible transmission mode: MCPC and SCPC
  - Topology: star and et mesh
2. Satellite **IS 707 @359° East** for Indian Ocean subnetwork
  - Operation in FASTCOM(ALCATEL) mode on transponder 86/86, in global beam, in A polarisation and in C band
  - Possible transmission mode : MCPC and SCPC
  - Topology: star and mesh
3. Protocols
  - Data : Frame Relay, X25, Asynchronous(V24)
  - Voice : over Frame Relay

The network currently involves twenty two(22) countries, namely :

- BENIN, BURKINA FASO, CAMEROON, COMOROS, CONGO, IVORY COAST, France(, GABON, GHANA, MALI, CENTRAL AFRICAN REPUBLIC, GUINEA(ROBERTS FIR), EQUATORIAL GUINNEA,

MADAGASCAR, , MAURITIUS, MAURITANIA, NIGER, NIGERIA, SAO TOME AND PRINCIPE, SENEGAL, CHAD, TOGO.

- In a near future its deployment will concern SOUTH AFRICA and ALGERIA.

Satellites IS 601 and 707 coverage maps are illustrated in appendix .

□ **CAFSAT(Central Atlantic Firs VSAT) network**

The network is built around INTELSAT satellite IS 801@ 328.5° East .

- Operation in IBS mode and in C : band
  - on transponder 20/20 for hemispheric beam
  - on transponder 38/38 for global beam
- Transmission mode: MCPC
- Protocols :
  - Voice/Data : over Frame Relay
- Topology: mesh

The network currently involves six(6) countries, namely:

- BRAZIL, CAPE VERDE, SPAIN, MOROCCO, PORTUGAL and SENEGAL

The satellite IS 801 coverage map is illustrated in appendix .

**SADC (Southern African Development Community) network:**

The network is implemented around INTELSAT satellite IS 604@ 60° East .

- Operation in C band
  - On transponder 93/93 in zone south-west beam
- Transmission mode: SCPC/DAMA
- Data interface: RS 232, RS 422 or V35
- Voice compression : G 728(16kbps)
- Topology :star and mesh

The network currently involves thirteen (13) countries, namely :

- SOUTH AFRICA, ANGOLA, BOTSWANA, LESOTHO, MALAWI, MAURITIUS, MOZAMBIQUE, NAMIBIA, RDC, SWAZILAND, TANZANIA, ZAMBIA, ZIMBABWE

In a near future its deployment will concern MADAGASCAR

Satellite IS 604 coverage map is illustrated in appendix.

**B. situational analysis**

Considering that:

- ✓ transmission delay is the most evident drawback of GEO satellite communications. In the context of aeronautical communications, dealing with air navigation safety, this feature is very important

The transmission delay comprises :

- propagation delay , due to the distance to satellite(36000 km) is about 260 ms for a single hop (up and down)
- transmission delay through baseband equipment (MUX, modems, FRAD, digital voice processing , notably), is typically about 200 ms end to end.

This means that the typical total delay of satellite link is 460 ms.

For a double hop satellite link, the delay is just below one second( 920 ms), which is sensitive for the following services:

- ATS/DS connections
  - VHF connections
  - RADAR data
  - CPDLC connections
  - Data service using an acknowledged transmission protocol(HDLC , X 25 , TCP, notably)
- ✓ Implication of four different satellites:
    - IS 801 for CAFSAT network
    - IS 604 for SADC network
    - IS 601 et 707 for AFISNET
  - ✓ different transmission modes : MCPC, SCPC et SCPC/DAMA
  - ✓ different operation modes: IBS and FASTCOM
  - ✓ different protocols and techniques used

Considering the above remarks; **interconnection** between these networks is not a **cost effective solution**.

### **III –ASECNA PROPOSAL:**

The proposed solution is the integration: the operation of these networks seen by the user, as only one network(transparency).

Accordingly, the only solution so that AFI Region, can play a significant role within the framework of new CNS/ATM systems , is the interoperability of these existing VSAT networks ; namely:

- use of:
  - IBS operation mode
  - INTELSAT satellite at 359°East orbital location; IS 10-02, scheduled in 2003( coverage map in appendix) for its suitable coverage
  - multiple protocol:: FDMA( MCPC ) in short term and CDMA(Code Division Multiple Access) in medium term.
  - compatible standard, specifications, procedures and equipment
- organisation of a meeting with INTELSAT by ASECNA, involving Organisations providing air navigation services in AFI Region
- creation of a working group (tasks and calendar)

✓ **BENEFIT**

- Consolidation of services on one satellite
  - Economies of scale for space segment acquisition
  - Implementation of a global ATN subnetwork in AFI Region
    - Seamless communications
    - Continuity of service
    - Harmonisation of techniques, protocols and equipment
    - Improvement of quality of service
  - Implementation of an aeronautical administrative communications subnetwork uniting Organisations , providing air navigation services in AFI Region :
    - Aeronautical Intranet
    - In real time, simultaneous dialogue and co-ordination between Directors of Organisations, providing air navigation services
    - Teleconferencing(audioconference)

✓ **Drawback**

the only drawback is to line up the whole of earth stations on the proposed satellite(IS 10-02 )

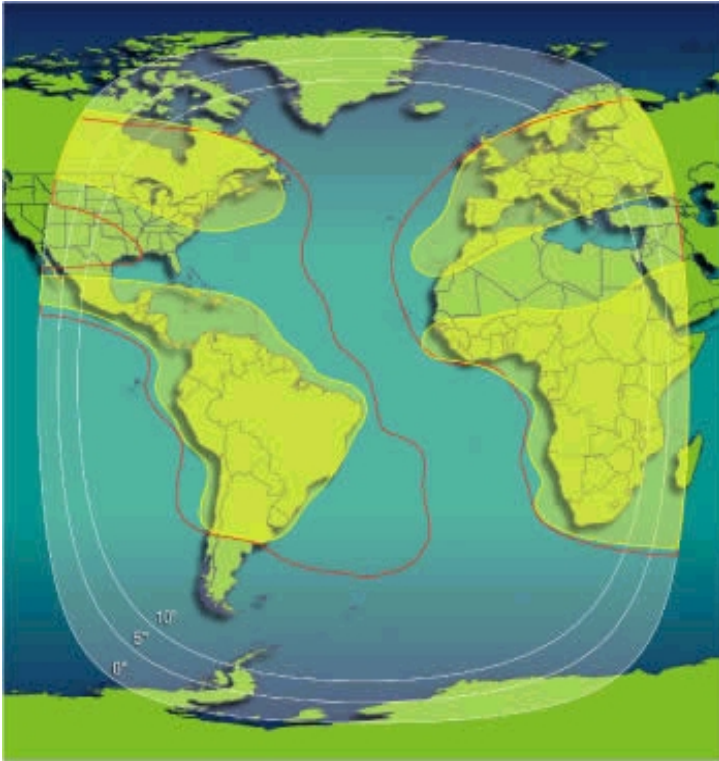
**IV - CONCLUSION :**

The meeting is invited to :

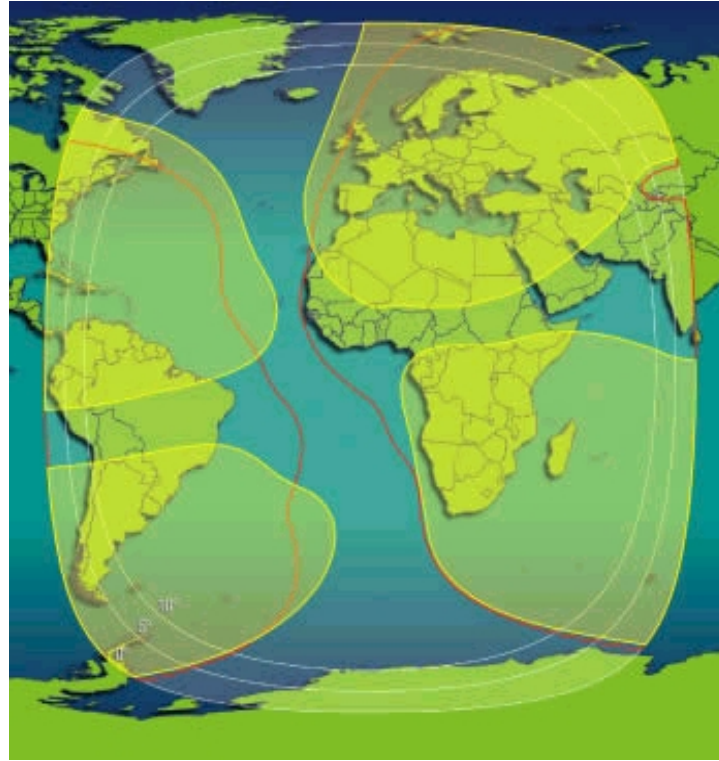
- note the above communicated information .
- create a steering Group , to examine the matters and make expert proposals to COM Sub-group
- call on Responsible of SADC, CAFSAT and AFISNET networks for their integration

# **APPENDIX**

**IS 601 COVERAGE MAP**



**IS 707 COVERAGE MAP**



Hemi

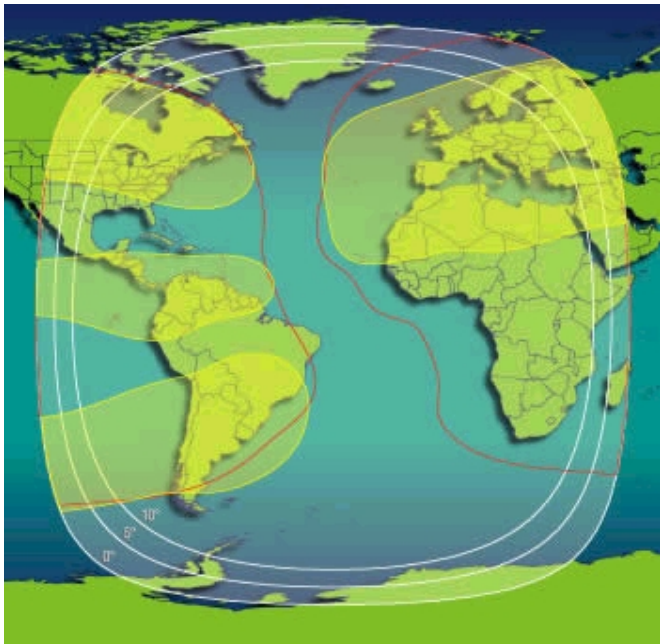


Zone

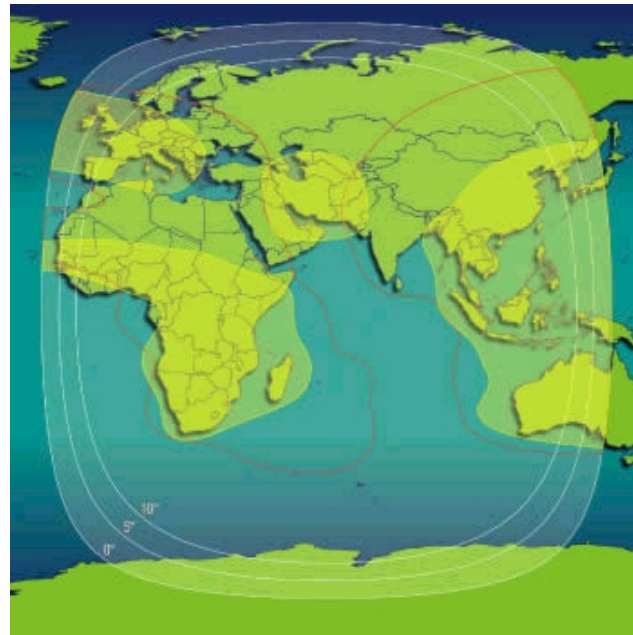


Global

**IS 801 COVERAGE MAP**



**IS 604 COVERAGE MAP**



Hemi



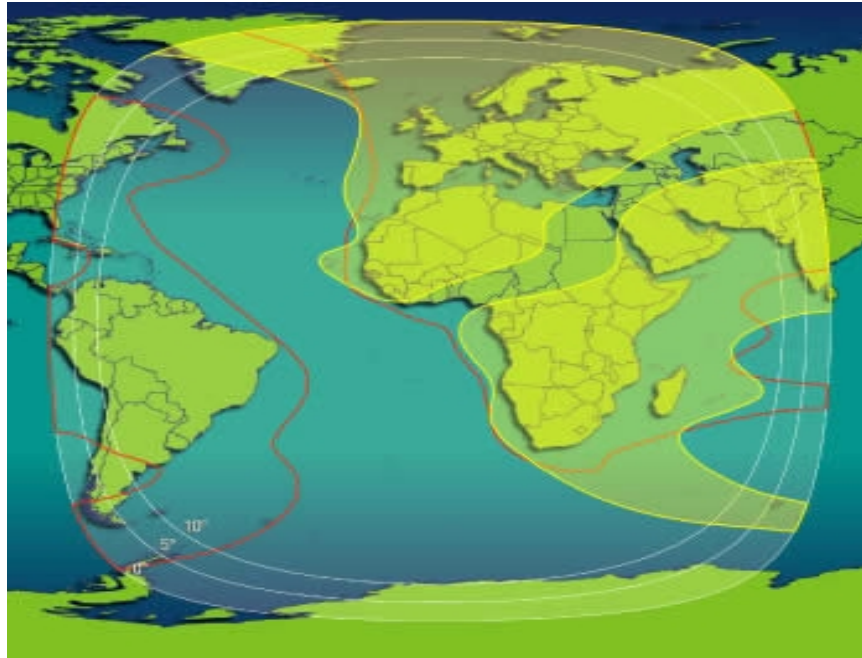
Zone



Global



## IS 10-02 @ 359° East COVERAGE MAP



Hemi



Zone



Global