MIDANPIRG/7
Appendix 5J to the Report on Agenda Item 7

PRELIMINARY STUDY OF THE MIDDLE EAST VSAT NETWORK

1. INTRODUCTION

1.1 The 5 Million km2 of the 15 MID States FIRs, which is strategically located at the interface between Europe, Africa and Asia, has seen a significant increase in traffic during the last years and indicators are that this tend will continue.

1.2
committed to provide within their respective FIRs air navigation facilities, including the means of communications, to facilitate operations.

2. CURRENT MEANS OF TELECOMMUNICATIONS

2.1 To achieve this goal, the service providers of the MID States have been using several leased lines from their National Telecommunication Administrations

2.2 However, some disadvantages related to the utilisation of leased lines has been practically noticed:

- high cost
- insufficient bandwidth
- frequent disruptions
- less priority in intervention on solving disruptions

2.3 In a parallel with leased lines, some service providers in the Region have started implementation of private satellite networks to meet their domestic requirements.

2.4 It is worth noting that the current aeronautical applications (PBX, ATS, AFTN, VDL,

enable to migrate towards new technologies.

3. REPERCUSSION ON SAFETY

3.1 As it is known that the mentioned deficiencies will impact on safety, regularity and efficiency of air navigation in the Region.

3.2 With a view to enhance the quality of aeronautical communications in the Region, the MIDANPIRG/6 meeting accordingly encouraged the MID States and the ICAO MID Regional Office to study the cost effectiveness and the technical feasibility of the use of VSAT.

4. FUTURE MEANS OF TELECOMMUNICATIONS

4.1 The MID VSAT (Middle East VSAT) network is composed of fifteen (15) nodes. Each node is established in each of the fifteen (15) MID air providers of the ICAO MID Region (see the attached document).

5. NETWORK TOPOLOGY

5.1 The MID VSAT digital networks is a totally meshed network, which topology is determined by the need of links between its nodes.

5.2 The MID VSAT network communication requirements are in conformity to the MID Air Navigation Plan and the FASID Document of ICAO that indicate the international communication requirements to be included in this network. Otherwise, during the elaboration of the final document, new circuits can be added in order to guarantee the redundancy and/or correct load of traffic of these communications.

5.3 The communication circuits are not necessarily between the MID VSAT nodes. The participating States wi
domestic dependencies, will be carried out automatically and without additional delay in case it involves voice circuits.

5.4 The network design has to permit that the communication requirements between nodes could increase, and that, associated nodes could be created without major changes in the current digital network philosophy, expressed in this document.

6. NETWORK BASIC CHARACTERISTICS

6.1 The MID VSAT has, as main objective, to satisfy the communication needs of the aeronautical fixed service (AFS)- in voice and data, current and future, required by the ATM, AIS, COM, MET and SAR units, as well as the new GNSS augmentation services, radar data interchange, administrative and maintenance communications.

6.2 The MID VSAT will be a compatible sub-network of the Aeronautical Telecommunications Network (ATN) facilitating the sub-network services in the dissimilar network-environment of the CNS/ATM systems. The MID VSAT should act as a link between the local network systems developed by the MID States, and if possible, should facilitate the interconnection with other regional digital networks (ASIA-PAC/AFI).

6.3 The MID VSAT should support the required services, in an efficient cost way, with high reliability, quality, and availability; with minimum delay in the aeronautical communications, in order to guarantee the security of air operations.

6.4 The MID VSAT is an aeronautical digital communication network, with a ten (10) years estimate life period. It is an open architecture and state-of-the-art technology network:

- totally meshed topology: flexible and scalable to facilitate changes and expansion of the network
- high availability
- distributed intelligence between its nodes
- no fault common points
- traffic priority with dynamic administration of the band width demand
- automatic alternative routing in case of fault
- network management system (NMS), for supervision and remote maintenance

6.5 The MID VSAT network is a distributed architecture which establishes in each node a multi-service platform (voice and data) / multi-protocol (switch and multiplexing), based on Frame Relay or ATM protocol with dynamical administration of the bandwidth.

6.6 The MID VSAT must be used as primary means to establish the inter-nodal through a VSAT stations network and, as a way of backup of dedicated circuits and ISDN switched connections,

which can be established over optic fibre or digital microwaves earth networks.

6.7 Finally when the earth digital networks will be developed in the Region and their operation costs decrease, the MID VSAT has a plan to use this way as primary means, and the VSAT system as backup and for the handling of overload.

7. SATELLITE ACCESS TECHNIQUES

7.1 In order to meet the needs of the MID VSAT to federate voice and data communications system using 15 identical nodes two techniques of satellite access are proposed : **TDMA** (Time Division Modulation Access) and **MCPC** (Multiple Channels Per Carrier).

7.2 **TDMA** This technique is based on VSAT system which is designed for easy expansion where attention is to be paid on balancing between VSAT hardware cost/size and satellite space segments costs.

7.3 A study on the latter item should be carried out with the satellite service providers ARABSAT and INTELSAT.

7.4 The PVCs over TDMA have capacity granularity that can enlarge according to the need with the relevant correspondent. A certain bandwidth is permanently reserved at start up so, the circuit is guaranteed regardless of other traffic demands.

7.5 The remaining bandwidth is allocated to voice (administration/maintenance) and data (AFTN, ATN, GNSS and NMS).

7.6 In the event of satellite network failure, the use of frame relay allows to connect to a designated alternate site.

7.7 Even though many manufacturers propose ATM technology in replacement of Frame Relay, this latter remains more secure and available in case it involves voice circuit.

7.8 The overall network availability for the redundant TDMA VSAT configuration must be calculated so that the target for 99,9% availability (without using the ISDN back-up network) to be met.

7.9 **MCPC** - In this technique, each node transmits one carrier frequency that is received by all of the remaining nodes in the network. The FRADs at each node filter out packets addressed to that node.

7.10 The MID VSAT must be designed for easy expansion, with the minimum of additional hardware and space segment cost. This is achieved by the addition of demodulators and FRADs at each site.

7.11 MCPC remains the simplest and the most secure technology for operation, but at the same time, it is not an easy task to chose between the two kinds of technology: TDMA and MCPC. All will depend on the following points:

- case by case of requested network
- availability of personnel
- training of personnel
- needed philosophy

7.12 As for TDMA, the proposal is to offer a minimum cost solution for both VSAT hardware and space segment. Although the use of voice and data is similar to that of TDMA, the transmitted carrier is rounded to 64 Kb/s. This later data rate is used for all the link budget calculations, taking into account the amount of space segment needed and the SSPA size.

7.13 So, to achieve a fully mesh connected network, a demodulator is used for each of the carriers transmitted by the network.

8. CONCLUSIONS

8.1 The proposed study should be considered as a starting step. If the concept of MID VSAT is validated, this study should then be refined with information related to the comparison costs between leased lines and satellite segments; this will ease the approval process for the implementation of an eventual MID project.

8.2 Moreover, the MID States should indicate whether a domestic satellite network is already implemented in their airspace; in this case, they should provide the ICAO MID Office with all technical information on the operating equipments.

8.3 A site survey may be needed to evaluate:

- available applications
- future needs
- current communications support

8.4 The above consideration may lead to the decision for a comprehensible study of a MID VSAT as a Regional Project.

9. ACTION BY THE MEETING

9.1 The Meeting is invited to consider the above information and to allow the continuation of the survey in order to provide MIDANPIRG meeting with a set of necessary elements allowing him to make a decision.
