Performance of VSAT Networks in the Context of Aeronautical Communications

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Use of correct terminology

Interconnection?  

Interoperability? ✗

Integration?  

Integration means that the two networks effectively become one! (the preferred option if feasible)
ALLPIRG/5 Conclusions on VSAT (Approved by ICAO Council on 13 June 2006):

5/16 – Implementation of VSATs

That PIRGs

a) discourage the proliferation of VSAT networks where one/some of the existing ones can be expanded to serve the new areas of interest;

b) work towards integrated regional/interregional digital communication networks with a single (centralized) operational control and preferably based on the Internet Protocol (IP); and

c) give due consideration to managed network services (e.g. a virtual private network (VPN)), subject to availability and cost effectiveness.
Conclusion 5/17 – Provisions for digital communication networks

That ICAO:

a) expedite the development of provisions relating to the use of the Internet Protocol Suite (IPS) in the aeronautical telecommunications infrastructure; and

b) initiate the development of provisions governing the end-to-end performance of digital communication networks, irrespective of the technologies and protocols used therein.
PERFORMANCE PARAMETERS

AVAILABILITY

99%? - 99.999%?  LET’S BE REASONABLE

Assuming no equipment failure, a single 2.4 m C-band VSAT in Dakar (using IS-903 @325.5 Deg), will experience sun outages about 2 hours per year.

Maximum availability is therefore 99.97%

Allowing for other expected problems, 99.8% (about 18 hrs of outage per year) is a reasonable figure.
Options for enhancing availability

Option A

Option B

Option C is easiest and most cost effective
PERFORMANCE PARAMETERS
Bit Error Rate (BER)

Errors are caused by noise. Higher Signal to Noise Ratio (SNR) reduces BER.

- More uplink power
- Higher satellite EIRP
- Larger Rx antenna size
- Low noise Rx amplifier
- Forward Error correction (FEC)

A reasonable figure for VSAT BER is $10^{-7}$
PERFORMANCE PARAMETERS

Voice Blocking Probability

Similarly, if there are N VSAT terminals, it is too costly (& outdated) to have N voice channels available at all times for ATS-DS circuits (for total non-blocking performance).

In a modern VSAT network, a blocking probability of 0.25% is quite reasonable (i.e. one in 400 attempts will be unsuccessful).
According to ITU-T Rec. G.114, one-way voice latency limits are:

* less than 150 ms for most users
* 150-400 ms, acceptable if can be tolerated by users
* above 400 ms, unacceptable for general network planning purposes (though may be unavoidable in some cases)

RF Propagation delay (one hop) $\geq 240$ ms

Call set-up delay $\leq 2$ Seconds
OVERVIEW OF COMMUNICATION LAYERS

AMHS

Transport layer

TP4 (ATN)

TCP

UDP

Network layer

CLNP

or

IP

Data link layer

(e.g. Frame Relay)

Physical layer

(e.g. QPSK/TDMA/DAMA)

E-MAIL, WWW

VoIP

Digital Voice

VSAT Network
Summary

* Proliferation of VSAT networks should be avoided

* Any upgrade opportunity should be used to integrate (i.e. under a single NCC) existing VSAT networks

* No more dedicated circuits! The trend is an IP-based VSAT network for all voice and data applications
Thank you for your attention

Any Questions?