Usage of FSS VSAT for safe operation of aircraft and distribution of meteorological information in Africa

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Objective

To review the usage of FSS VSAT for safe operation of aircraft and distribution of meteorological information in Africa

Aerounautical communication

- Global system can only operate efficiently through exchange of speech and data.
- Safe, efficient and real time provision of air traffic management (ATM)
- Global, Regional and National networks, main centres and satellite stations as nodes of network
- Mobile Communication- Route , Off-Route, Ground -Air or Air to Air
- Fixed Communication- Ground to ground

Aeronautical Communication

- Aeronautical Fixed Telecommunications Network (AFTN) messages: distress ;urgency ;flight safety;meteorological; flight regularity ;aeronautical information services (AIS);aeronautical administrative and service.
- Air Traffic Services Direct Speech Network (ATS/DS),
- ATS Handling Message System (AHMS), ATS Inter-Facility Data Communications (AIDC)], VHF radio coverage
- Global Navigation Satellite System (GNSS) Satellite-Based Augmentation System (SBAS), Remote control circuits to Navigation aids and Surveillance systems integration.

VSAT Implementation

- Very Small Aperture Terminal refers to receive/transmit terminals installed at dispersed sites connecting to a central hub or to other stations via satellite using small diameter antenna dishes (0.6 to 3.8 meter).
- Fixed satellite antennas provide highly reliable communication means for data, voice and fax between almost any number of geographically dispersed sites.
- Earth station - used to receive satellite transmissions mounted on a roof on a wall, or placed on the ground, No terrestrial leg

VSAT Implementation

- Global and regional fixed networks initially used terrestrial links
- VHF coverage by use of Telecom repeater stations
- Poor connectivity to remote and war torn areas and poor VHF coverage led to untimely Communication exchange
- The Limited Africa-Indian Ocean Regional Air Navigation Meeting of 1988 (LIM AFI RAN/1988) recommended use of satellite Very Small Aperture Terminals (VSAT) in the AFI Region
- VSAT project (AEROSATEL) in early 1990s and extended to AFI Satellite Telecommunications Network (AFISNET).

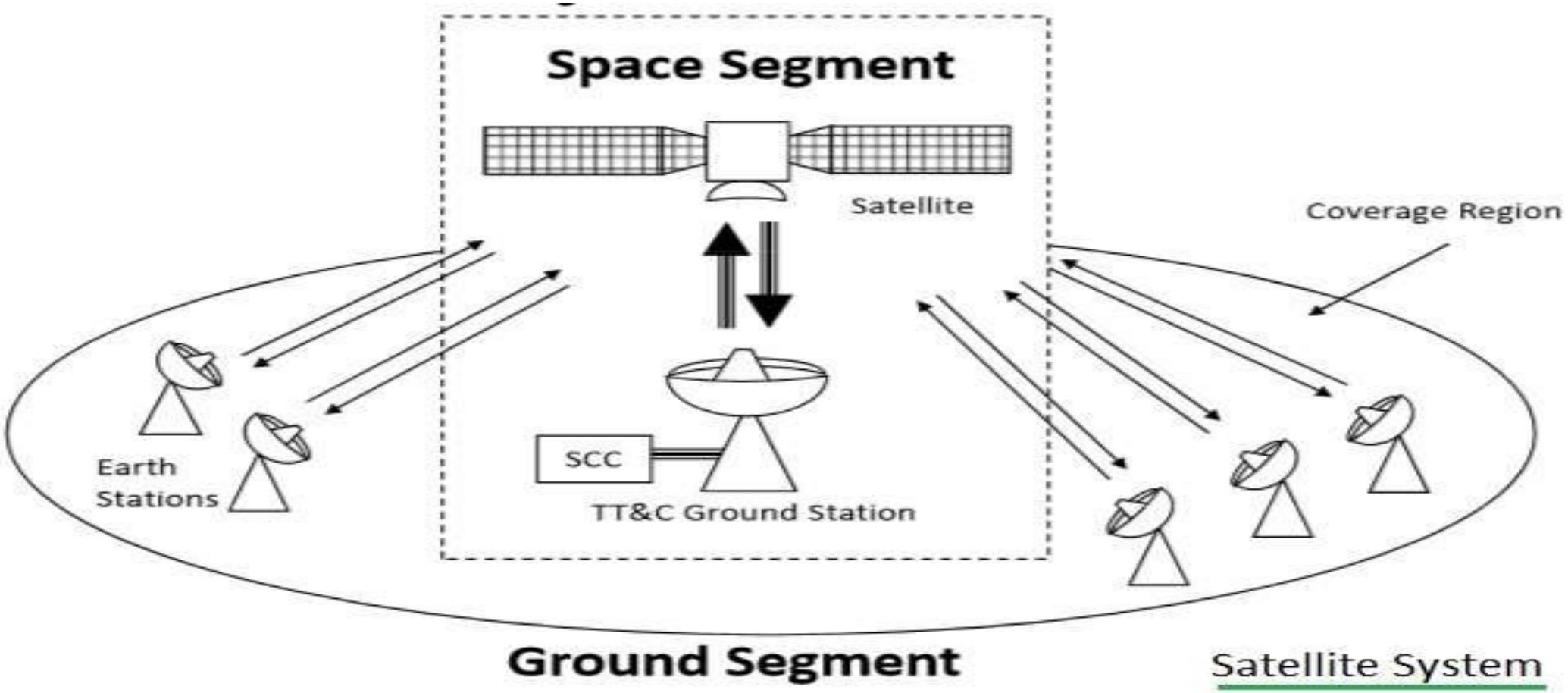
VSAT Implementation

- Early 2000s : South African Development Community (SADC VSAT/1).
- New generation: (SADC VSAT/2) launched in 2008 with the inauguration of a new VSAT network for North-Eastern African States (NAFISAT).
- African, European and South American States, the Central Atlantic FIRs Satellite Telecommunications Network (CAFSAT), to cater for requirements between South Atlantic area control centres
- Resulted in great improvement in quality and reduction of deficiencies
- Brazaville circuit to Kenya as example

VSAT Implementation

- Networks developed by different grouping of States at different times characterized conceptual and technical varieties.
- Coordination and consideration to integrating existing VSAT networks necessary
- Integrated regional/interregional digital communication networks, centralized operational control and preferably Internet Protocol (IP)
- Recomended to enable Interconnectivity, Operational and technical inter operability
- Administrative arrangements:Supervisory committee, cost recovery mechanism, technical arrangements (personnel, maintenance), and network management (monitoring and control) introduced.

VSAT typical satellite: space segment, ground segment and TT&C (Tracking Telemetry & command station / satellite control center)



VSAT components

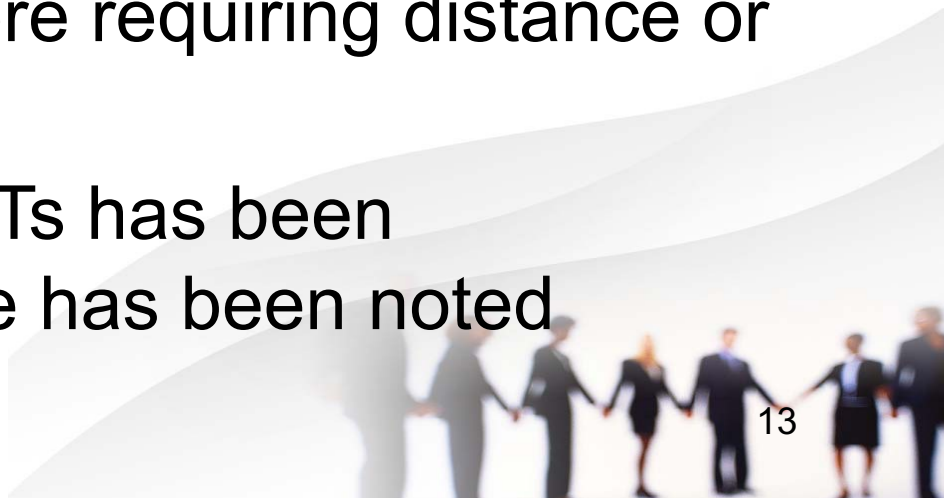
- Outdoor unit, Indoor unit and space component.
- Space Segment: satellite in space two way communication
- One frequency pair needed for establishing connection and operates as an active repeater in space
- A star topology, using a central uplink site, such as a network operations center (NOC), to transport data back and forth to each VSAT via satellite,
- A mesh topology, where each VSAT relays data via satellite to another terminal by acting as a hub, minimizing the need for a centralized uplink site
- Combination of both star and mesh topologies .

Challenges

- Maintenance capabilities, modernization of network components, ownership and funding arrangements and associated cost recovery mechanisms.
- Network provider needed for multi State networks with no institutional arrangement
- Many different ways of VSAT network implemention and VSAT vendors use of proprietary signal protocols leads to diversity
- Inter connectivity between nodes belonging to different VSAT networks difficult, costly, and sub-optimum in performance.

Conclusions

- Ground-ground networks based on VSAT technology offer the best means of providing Aeronautical Fixed Services (AFS) connectivity .
- Relaying air/ground communications between ATS centres and remote ground stations and Mobile services extended range.
- VSATs in Africa operate on C-band which is FSS and often Mobile systems, which are Primary, interfere requiring distance or Frequency separation
- Regulating protection of Aeronautical VSATs has been controversial but presence and importance has been noted



References

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- ICAO GANP Doc 9750
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Thank you