BAY-SAT / PolarSat

Ghana Air Traffic Control Network Overview

Outline

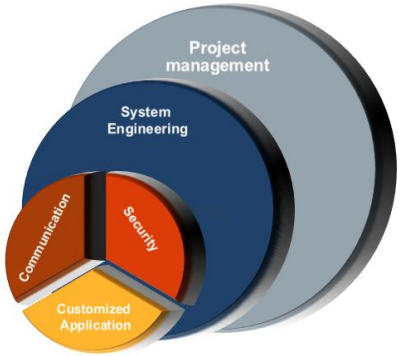
1. BAY-SAT / PolarSat Introduction
2. Overview of aviation based VSAT communications Network
3. GCAA Network Overview
1. Benefit Summary

1. BAY-SAT / PolarSat Introduction

BAY-SAT / PolarSat Introduction

BAY-SAT

- Engineering Company & Integrator
  - Focused on Africa
  - System integration
  - Project Planning & Managemt.
- Turnkey projects
- From Munich, Germany



PolarSat

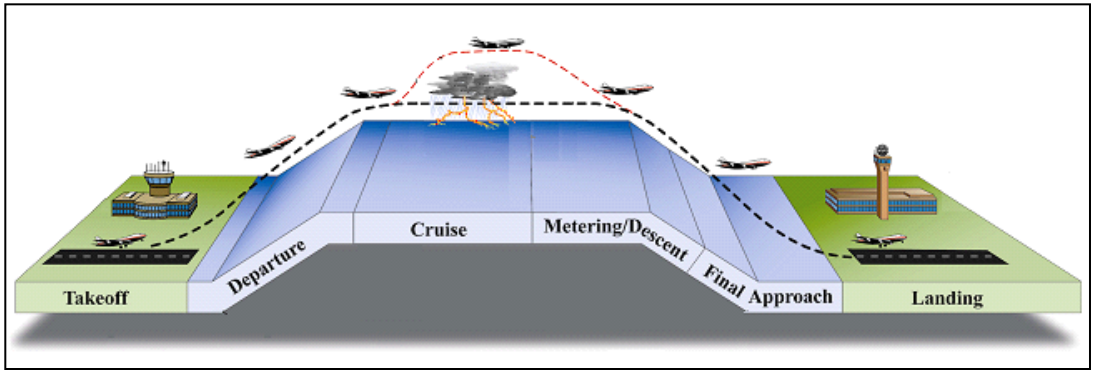
- Manufacturer of SATCOM equipment
  - Over 6000 VSAT terminals installed worldwide
  - Over 50 countries served
- From Montreal, Canada

VSATPlus 3
MF-TDMA

2. Overview of aviation based VSAT communications Network

Applications Support by ATN

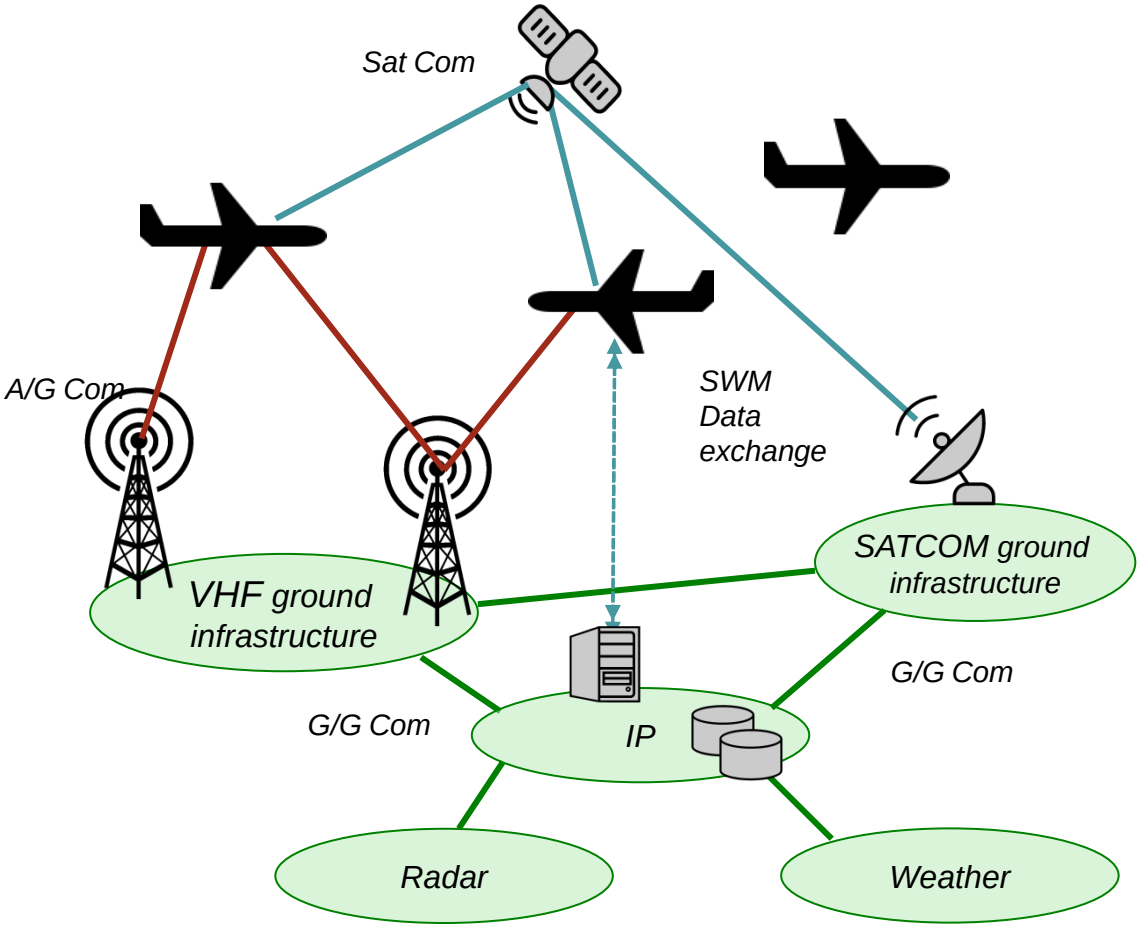
- Air Traffic Network supports the delivery of Air traffic Management (ATM) applications
- ATM is a group of functions / applications including:
  - Air Traffic Flow Management (ATFM)
  - Air Space Management (ASM)
  - Air Traffic Services (ATS)
  - To Simplify:
    - Radar
    - Weather
    - Routing
    - Voice
    - Flight Data



Simplified Aviation Traffic Network

- Aeronautical Telecommunications Network (ATN) provides:
  - Overall connectivity to support all elements of ATM
  - Ground network supports connectivity to the air in addition to ground to ground communications
- Elements are geographically dispersed
- VSAT provides a key communications element

Simplified Aviation Traffic Network



VSAT roles in GCAA ATN

- VSAT provides a reliable flexible method for ATN communications
  - Primary Network
  - Extension
  - Backup
  - Flexible Disaster response

VSAT roles in ATN

- VSAT's key role due to the wide variety of traffic and connectivity needed
  - Geographic coverage tends to be regional in nature
  - Common communications platform results in seamless ATM environment
  - VSAT covers multiple traffic flows
  - Traffic flows are a combination of multi-star and full mesh communication

VSAT Technology

- Three major VSAT technologies:
  - FDMA : star network and SCPC point to point (e.g. IBS)
  - TDMA : full mesh network
  - DVB-RCS : star network

- Typical Architecture uses
  - FDMA and DVB-RCS is point to point or a star network
  - TDMA is full-mesh

VSAT Technology

- TDMA + FDMA = “MF-TDMA”

–Multi-carriers and each carrier has TDMA structure

–Frequency Hopping in TX/RX for greatest flexibility

- MF-TDMA from PolarSat
  - Combines the best of FDMA and TDMA
  - Gives consistent delay for VHF-ER traffic (virtual SCPC)
  - Allows Bandwidth on Demand of other IP traffic
  - Flexibility to add sites or move traffic

3. GCAA Network Overview

GCAA Requirem’ts on new VSAT

- MF-TDMA VSAT network
- MPLS backup (1st in West-Africa)
- Redundancy and automatic switch-over
- VSAT backup for Sao Tome (satellite diversity)
- Multiple services, serial and IP

GCAA's new VSAT network

VSATPlus3 – solution:

- Fully-redundant VSAT network of 6 remotes and Accra ACC main site
- Antennas: Main Station 4,5 m, Remotes 3.8 m
- RF size : 10 Watts C-Band
- Full mesh Voice and Data connectivity
- No single point of failure in the network

GCAA's new VSAT network

- Full mesh IP VSAT network:

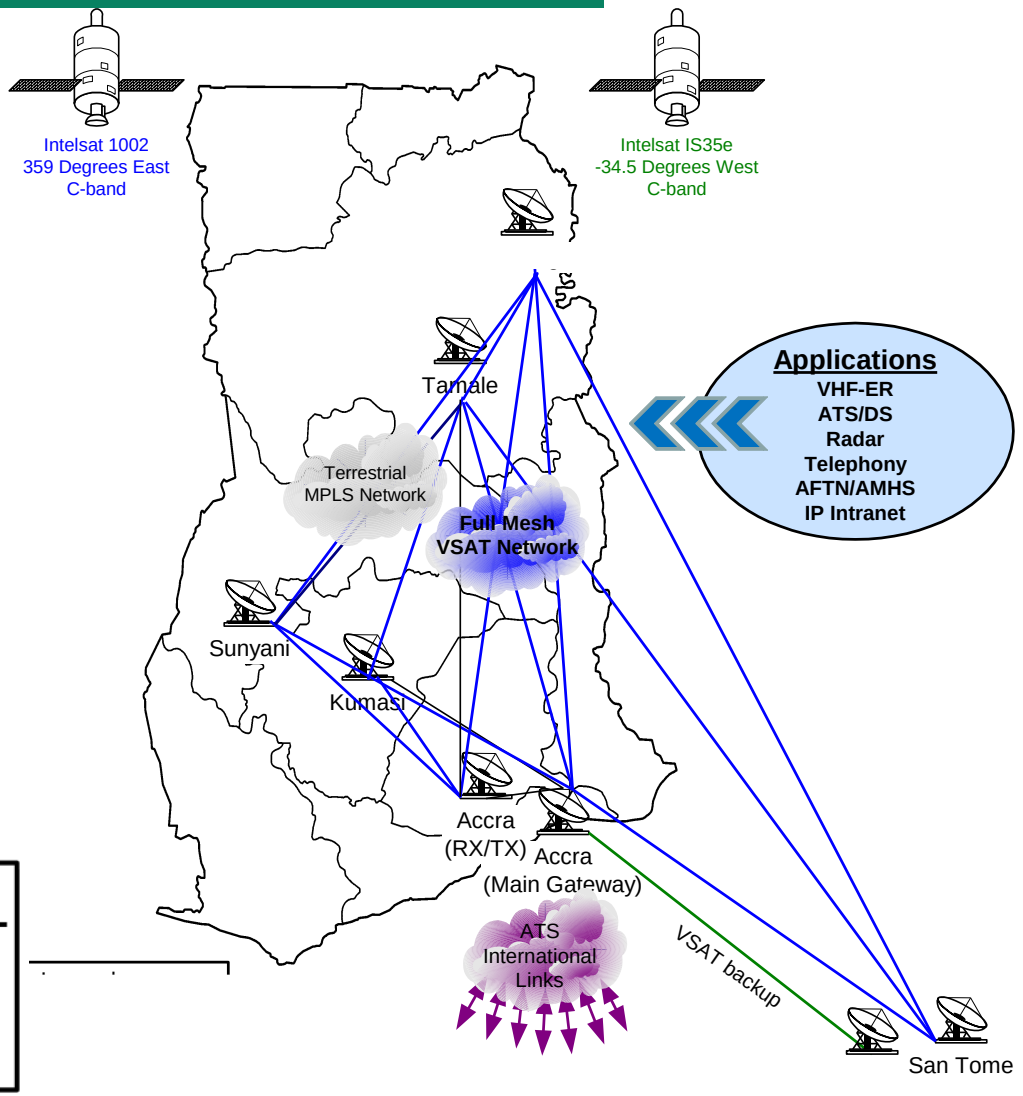
  One modem for all links!

- DAMA: Shared bandwidth for greater efficiencies
- High Reliability: hot redundant VSAT and Terrestrial
- Hubless VSAT operation with no single point of failure

GCAA's new VSAT network

- Support of legacy circuit traffic
- Growth with new IP application / Scalable network size
- Integrate services support with multiple applications
- Allows for multiple ACC centers without special equipment
- Option to integrate an overlay network

GCAA Network Overview



Legend

Blue -New VSAT Network
Green -New VSAT Backup Link
Purple -Existing ATS Links

ACCRA Site overview

- ACCRA Main site
  - VSAT installation has been completed
  - user traffic transitioned
  - MPLS installed
  - Existing traffic not impacted by upgrade

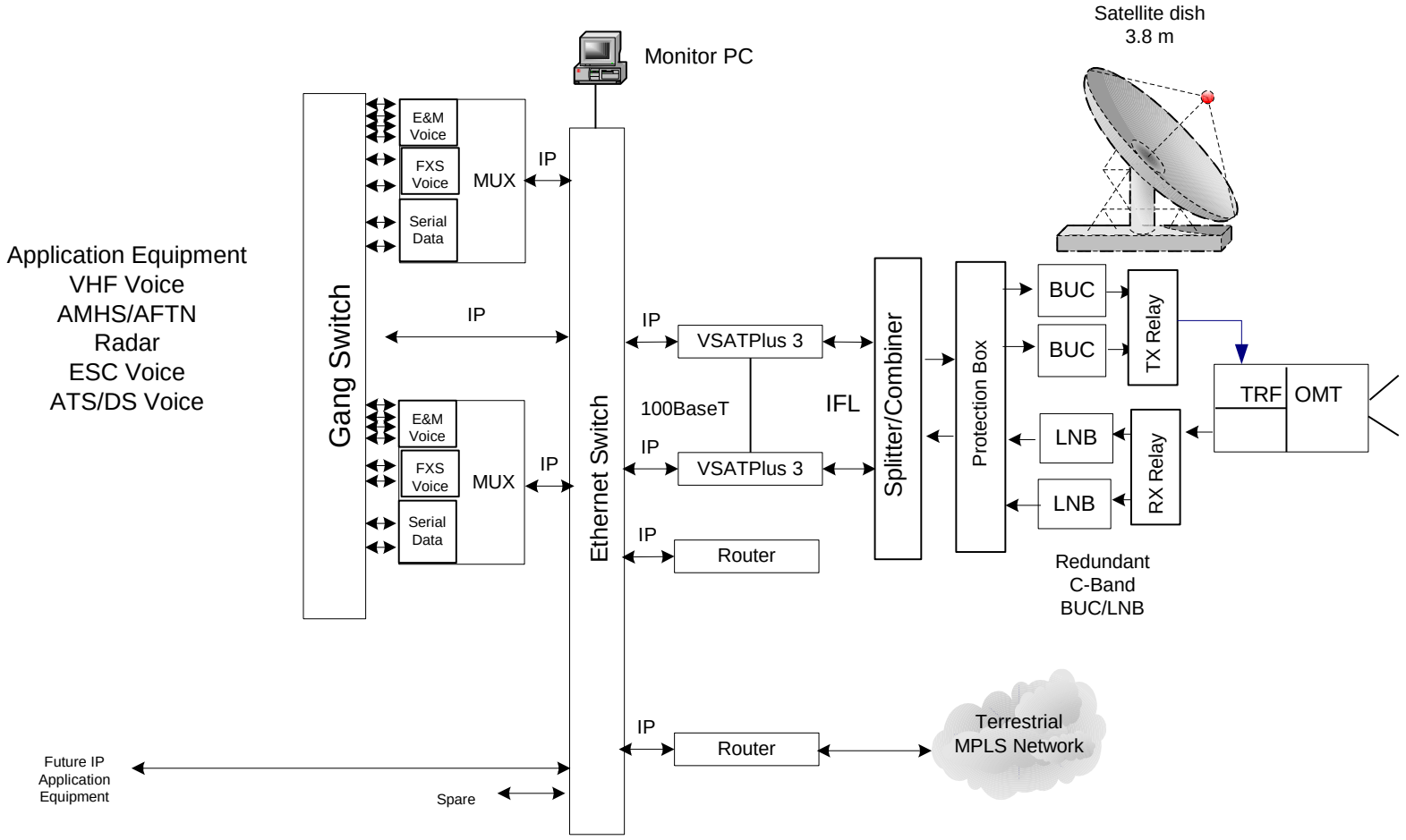
ACCRA Site overview

Remote sites overview

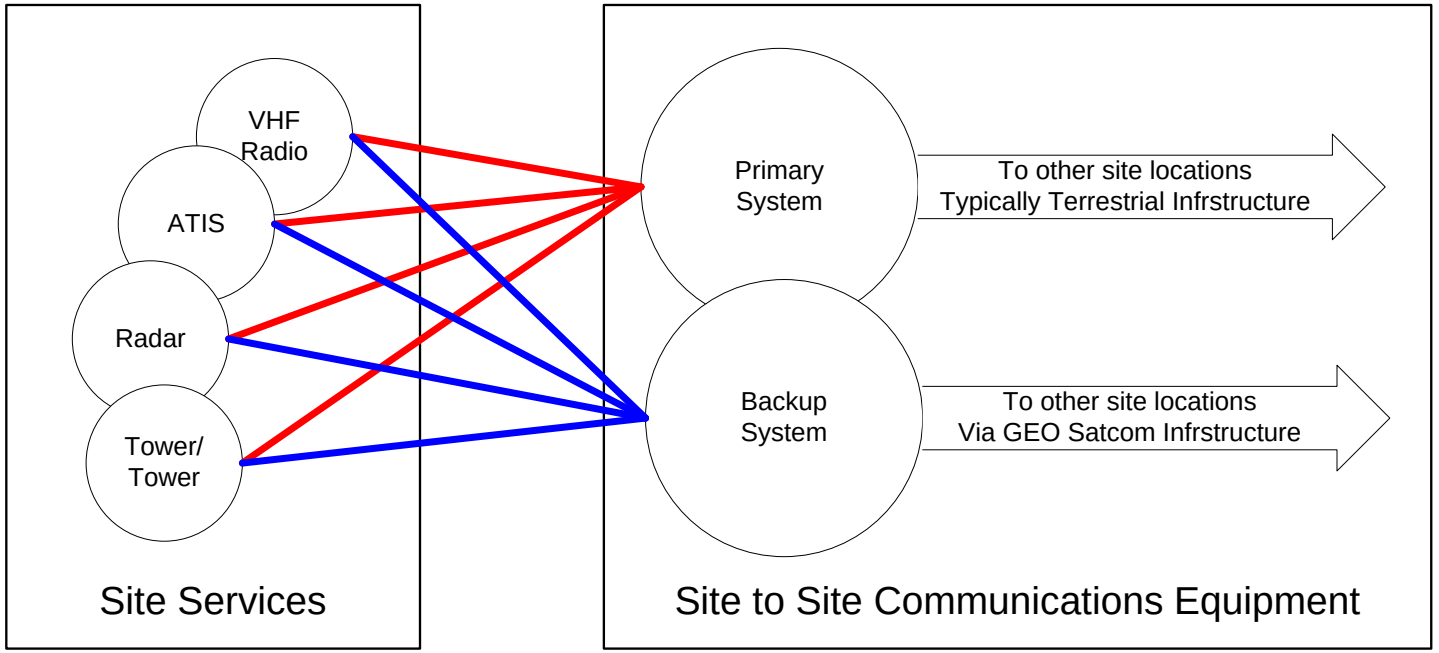
- Remote Stations
  - New VSAT Installation completed, user traffic transitioned
  - MPLS installed
  - Sites under commissioning

Remote sites overview

Remote site block diagram



VSAT as Primary / MPLS as Backup

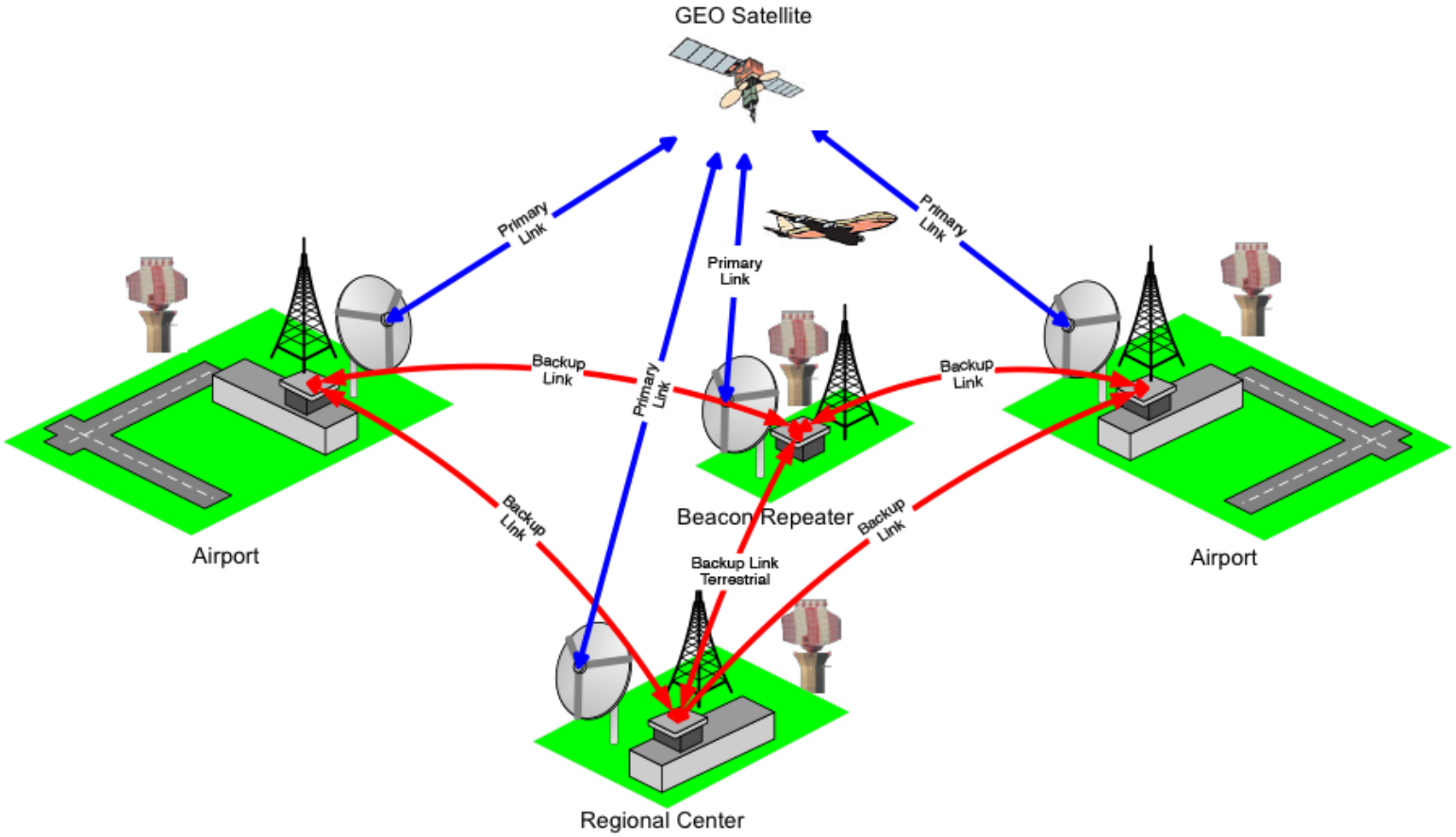


- Automatic switch-over between VSAT and MPLS
- Switching performed **per site**

VSAT as Primary / MPLS as Backup

- VSAT provides automatic backup to variety of services
  - Voice
    - Ground to air
    - Tower to Tower
  - Data
    - Radar data
    - Air Traffic
    - Messaging

VSAT as Primary / MPLS as Backup



4. Benefit Summary

Summary

- GCAA network benefits
  - High reliability
    - Redundant VSAT and Terrestrial
    - Hubless VSAT for no single point of failure
    - Hot redundant equipment
  - Low cost of operation
    - Greater efficiency of through bandwidth sharing
    - Combines dedicated bandwidth for delay sensitive applications (VHF) while supporting BOD for dynamic applications (Voice and IP data)
  - Easy expansion
    - Does not require the additional equipment at existing sites to add a new site.
    - New IP based application systems can be supported directly by the network
    - Additional bandwidth added to the system is accessible by all sites without having to reengineer point to point links

Questions and Answers

Thanks - Merci