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NO COUNTRY LEFT BEHIND

AFI/MID Workshop on Aviation System Block Upgrades (ASBUs)

Harmonization of implementation of

Ground-Ground Communications

(To achieve Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration)
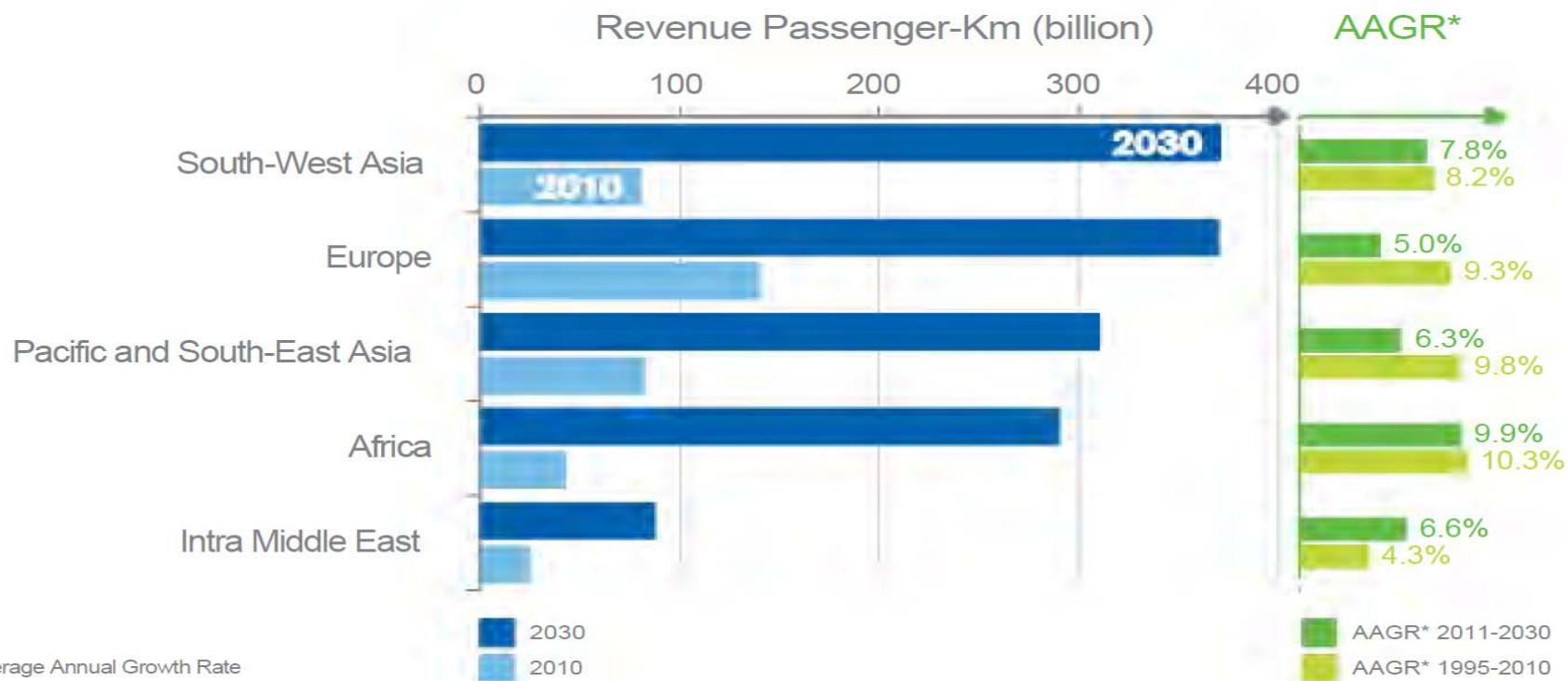
Cairo, Egypt
23-26 November 2015

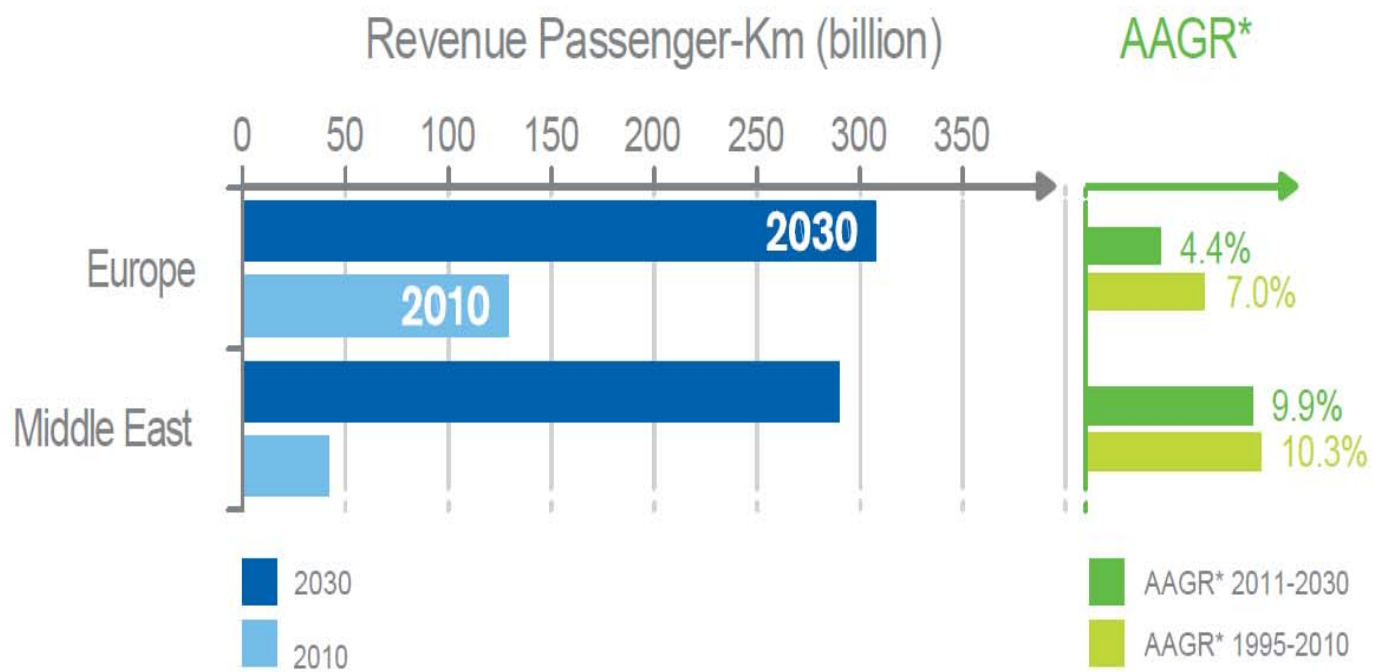**Presented by Prosper Zo'o Minto'o, DRD, ICAO ESAF Office**

Middle East Passenger Traffic by Route Group – 2010 vs. 2030

Revenue Passenger-Km (billion)   AAGR*

Route Group	AAGR* 2011-2030	AAGR* 1995-2010
South-West Asia	7.8%	8.2%
Europe	5.0%	9.3%
Pacific and South-East Asia	6.3%	9.8%
Africa	9.9%	10.3%
Intra Middle East	6.6%	4.3%

2030
2010

*AAGR: Average Annual Growth Rate

AAGR* 2011-2030
AAGR* 1995-2010

Africa Passenger Traffic by Route Group – 2010 vs. 2030

The Dilemma

Intelsat IS 10-02
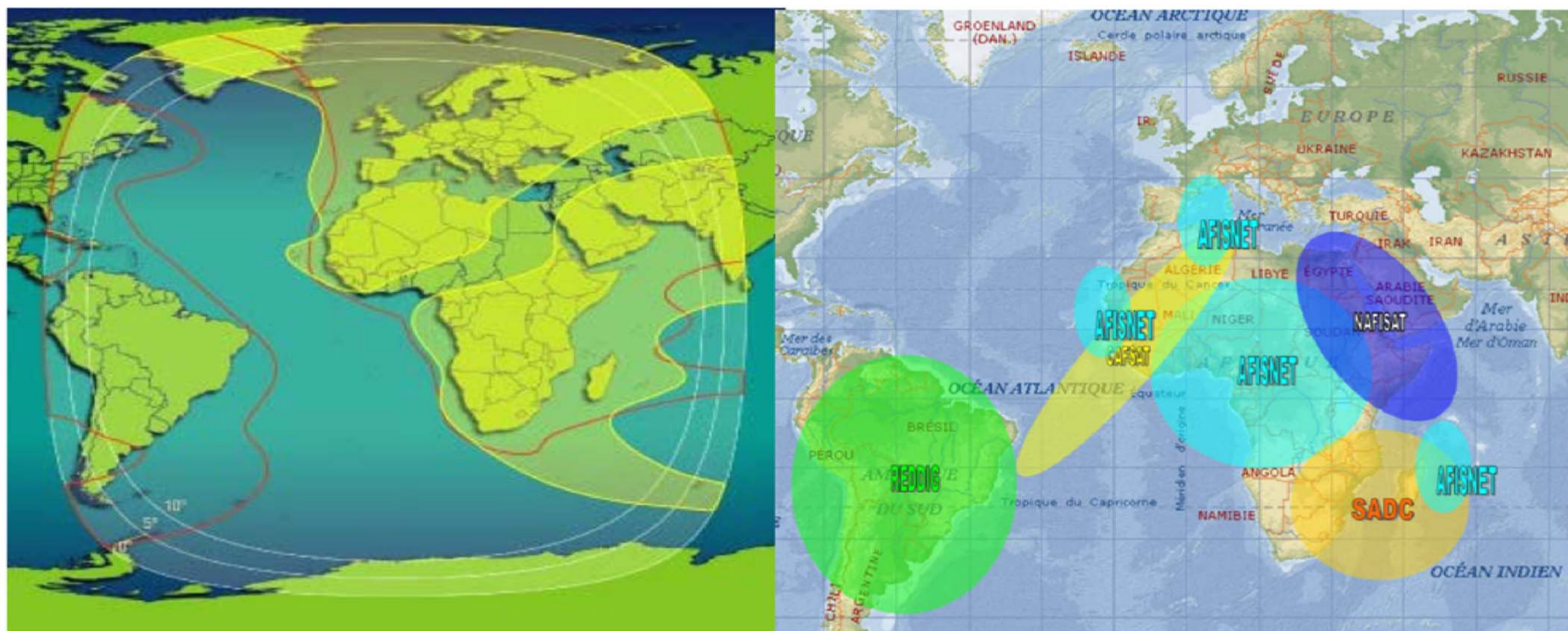
APIRG & MIDANPIRG

- **June 2001:APIRG/13 Conclusion 13/15**
  - Establishment of the North Eastern AFI VSAT Network (NAFISAT), covering States such as: **Chad, Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Tanzania, Uganda, Democratic Republic of Congo, Seychelles in the AFI Region**; **Egypt, Libya, Saudi Arabia; Sudan and Yemen in the MID Region;** and the interface with India;

- **February 2009: MIDANPIRG/11 Conclusion 11/55**
  - Following the successful implementation of Phase I of the MID VSAT Project and in order to avoid the proliferation of the VSAT networks, **MID States requiring VSAT connections may join the NAFISAT Network Project and participate in its steering Group**;

APIRG & MIDANPIRG

March 2012: Conclusion 18/26: Modernization of VSAT Networks

- **That AFI States and Organizations adopt and implement strategies to modernize networks and continue to meet regionally/inter-regionally agreed performance requirements.**

ALLPIRG/5 (2006)
Conclusion 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.
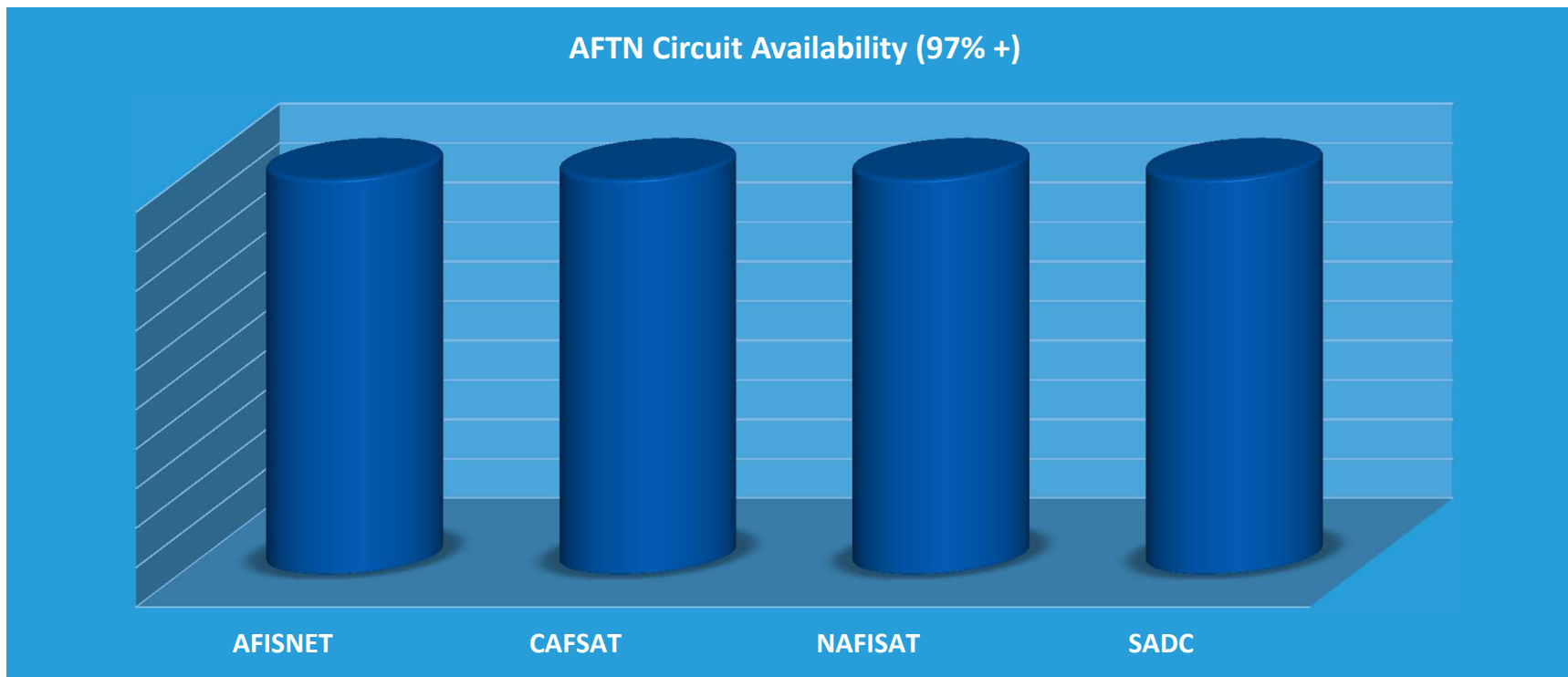
AFI ATN BACKBONE INTERCONNECTIVITY
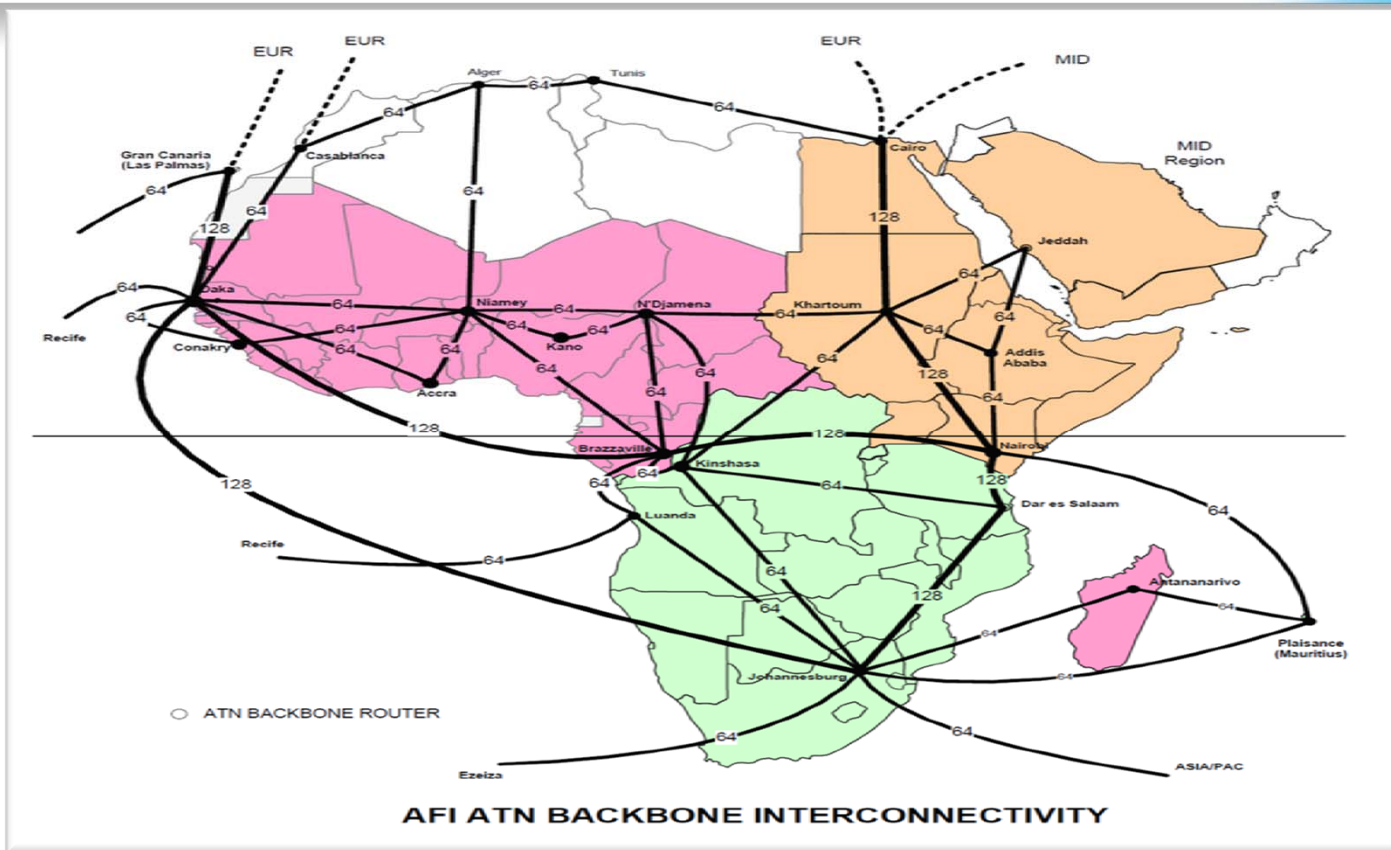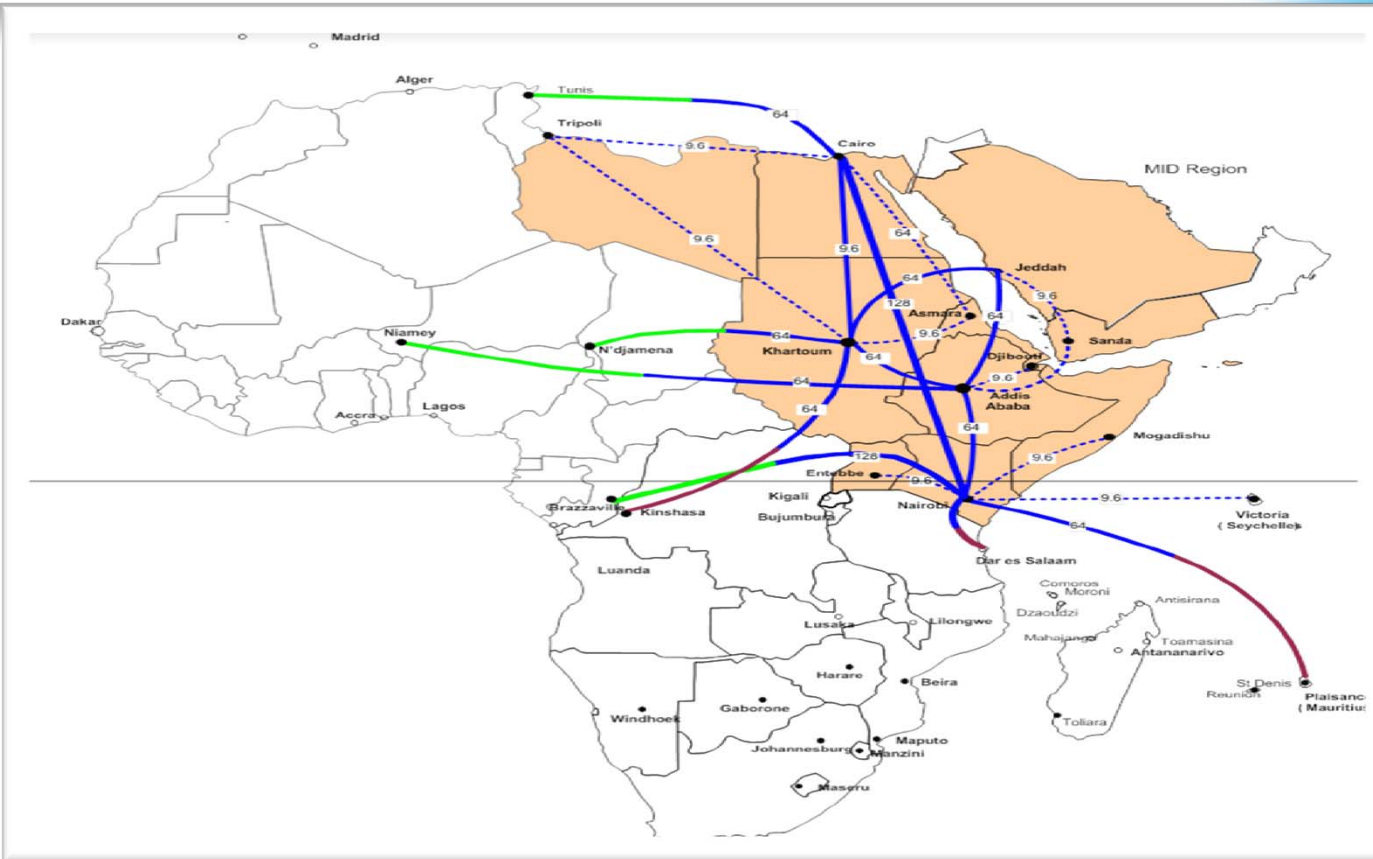
Minimum Performance Targets for VSAT networks
(ICAO SP AFI/RAN08)

Applicable to the overall ground-ground communication service as seen by the end user of a digital VSAT network

- *Availability >= 99.8%*
  - *It shows the required overall availability of the communication service to the end user, and includes the consideration of all scheduled/non-scheduled maintenance and sun outages.*

- *Bit error rate (BER) <= 1 in 10-7*
  - *BER is applicable to the physical layer of communications. Forward error correction (FEC) may be employed to achieve this figure.*

- *One-way latency < 400 ms*
- *Call blocking probability <= 2.5 x 10-3 (or 1 in 400 attempts)*
- *Call set-up time <= 2 s*

VSAT Networks – Gap Analysis

AFTN Circuit Availability (97% +)

AFISNET CAFSAT NAFISAT SADC

VSAT Networks – Gap Analysis

**Transmission Speed
(AFTN/1200 bauds)**

AFISNET   CAFSAT   NAFISAT   SADC

VSAT Networks – Gap Analysis

Transmission Speed
(ATN: 9.6 Kbps, ATN backbone: 64 Kbps)

| AFISNET | CAFSAT | NAFISAT | SADC |
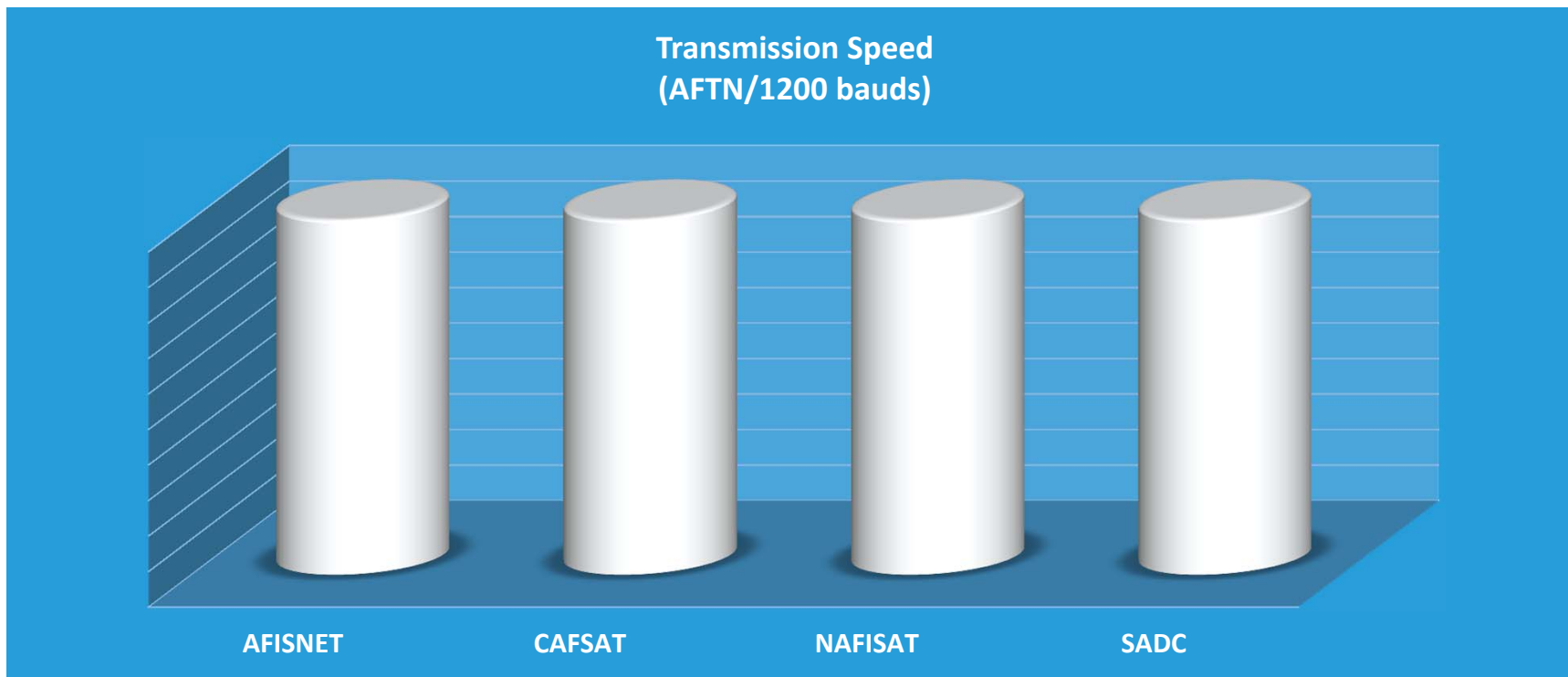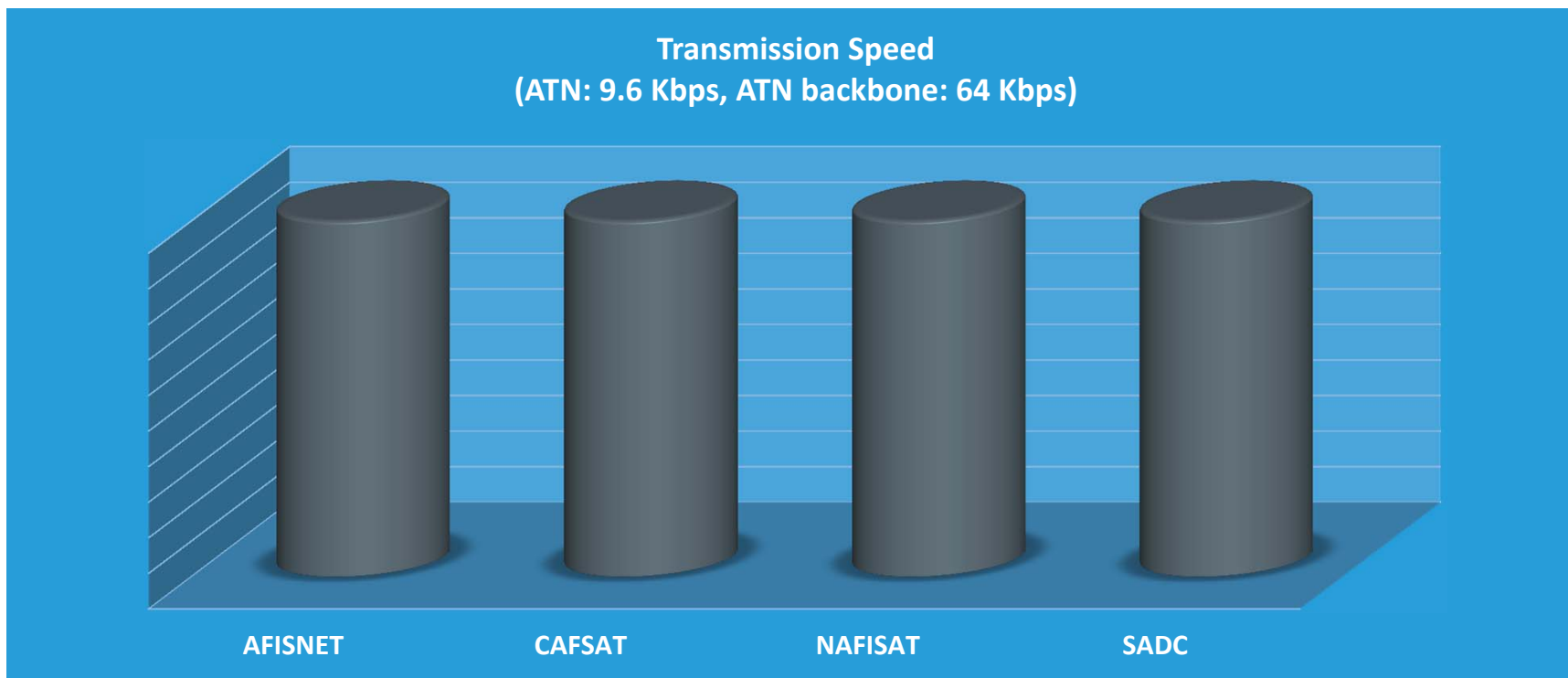
VSAT Networks – Gap Analysis

Message Transit Times (Quarterly Statistics)

AFISNET   CAFSAT   NAFISAT   SADC

VSAT Networks – Gap Analysis

Circuit Loading
(Traffic Volume, Traffic Statistics, Circuit Occupancy)

AFISNET   CAFSAT   NAFISAT   SADC
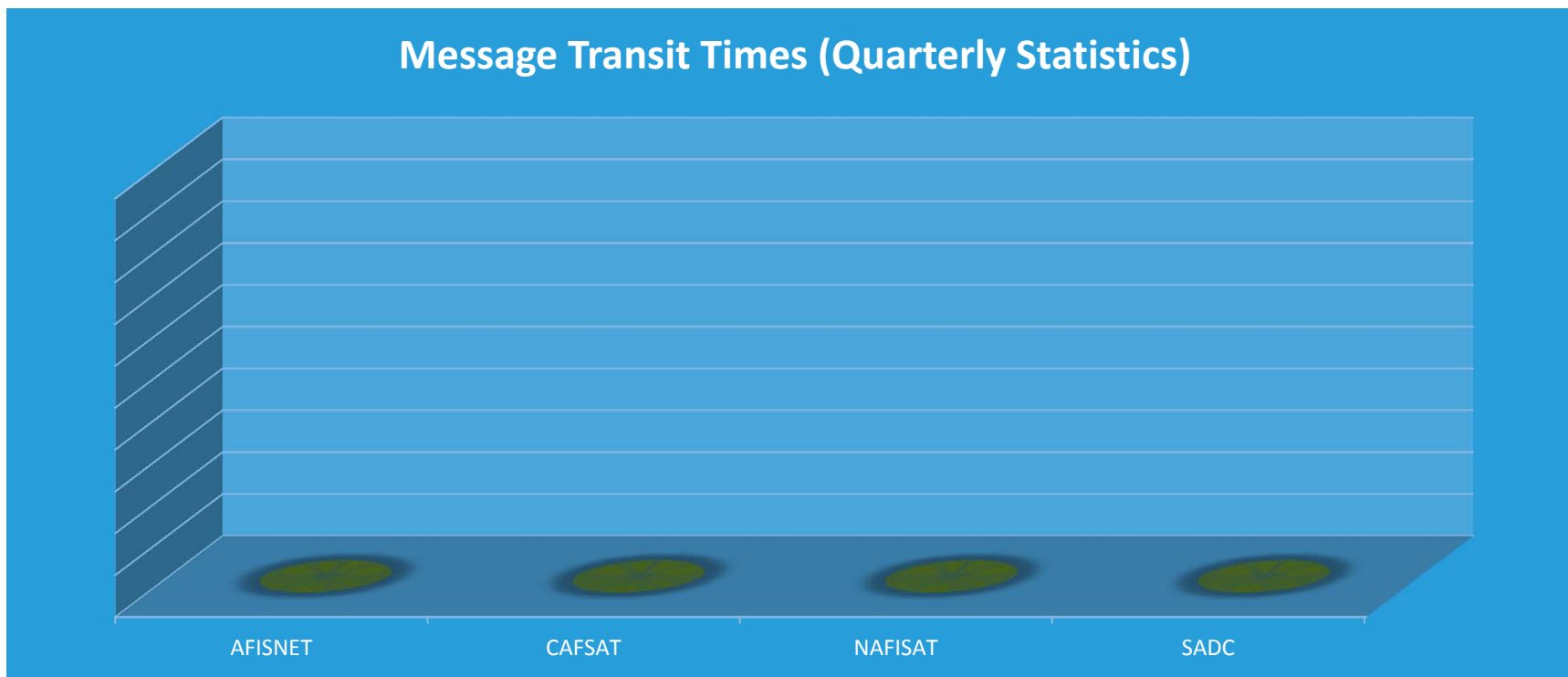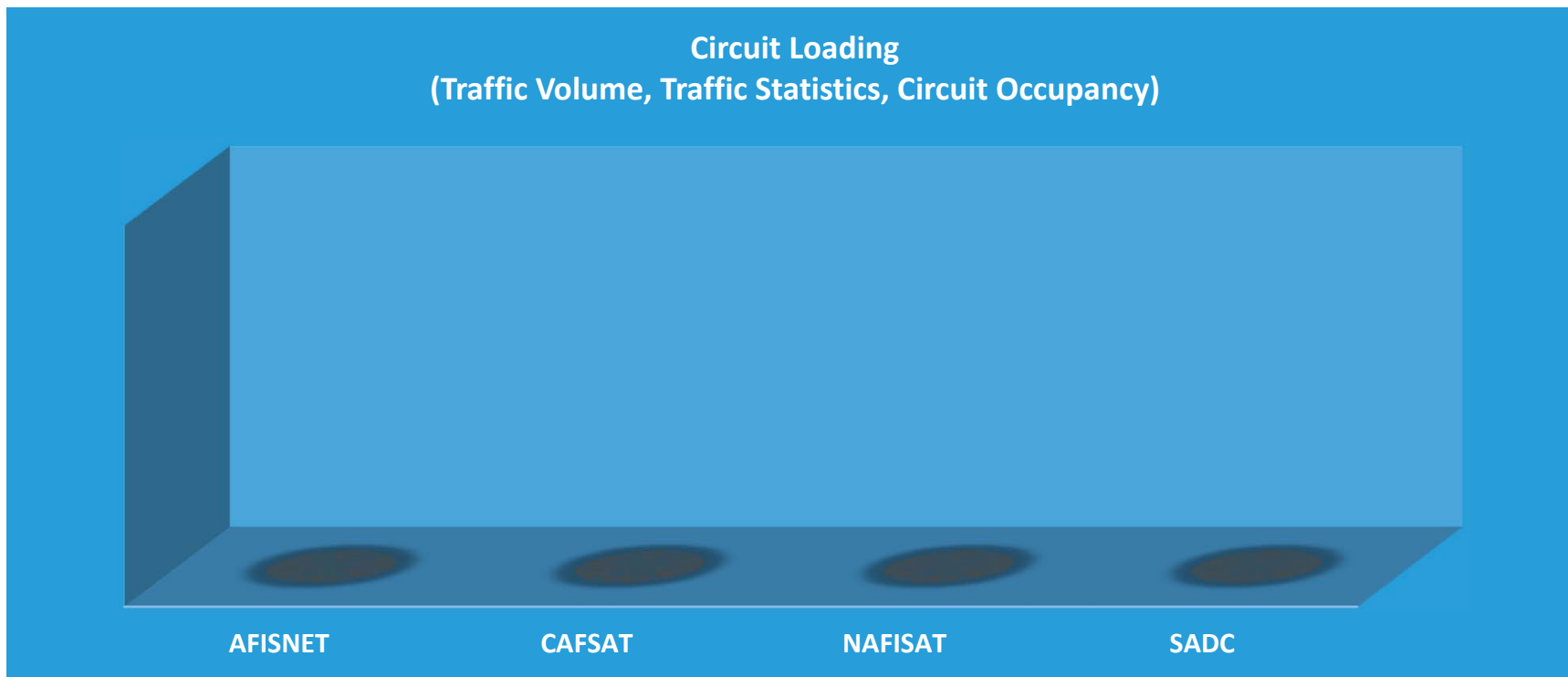
VSAT Networks – Gap Analysis

**Administrative Arrangements
(Operational, Technical and Financial Authority)**

AFISNET   CAFSAT   NAFISAT   SADC

VSAT Networks – Gap Analysis

Network control centre (NCC)

AFISNET | CAFSAT | NAFISAT | SADC

VSAT Networks – Gap Analysis

Satellite Access Method (MF-TDMA)
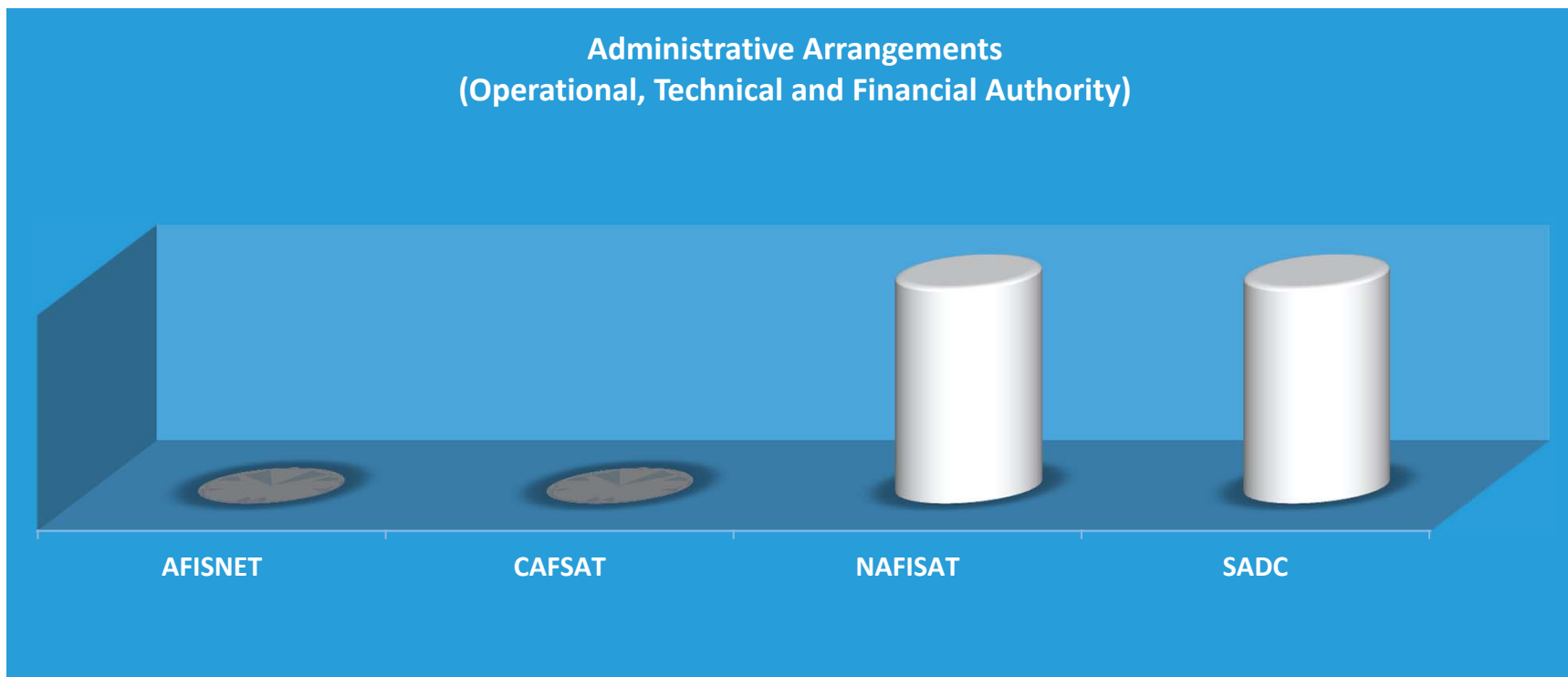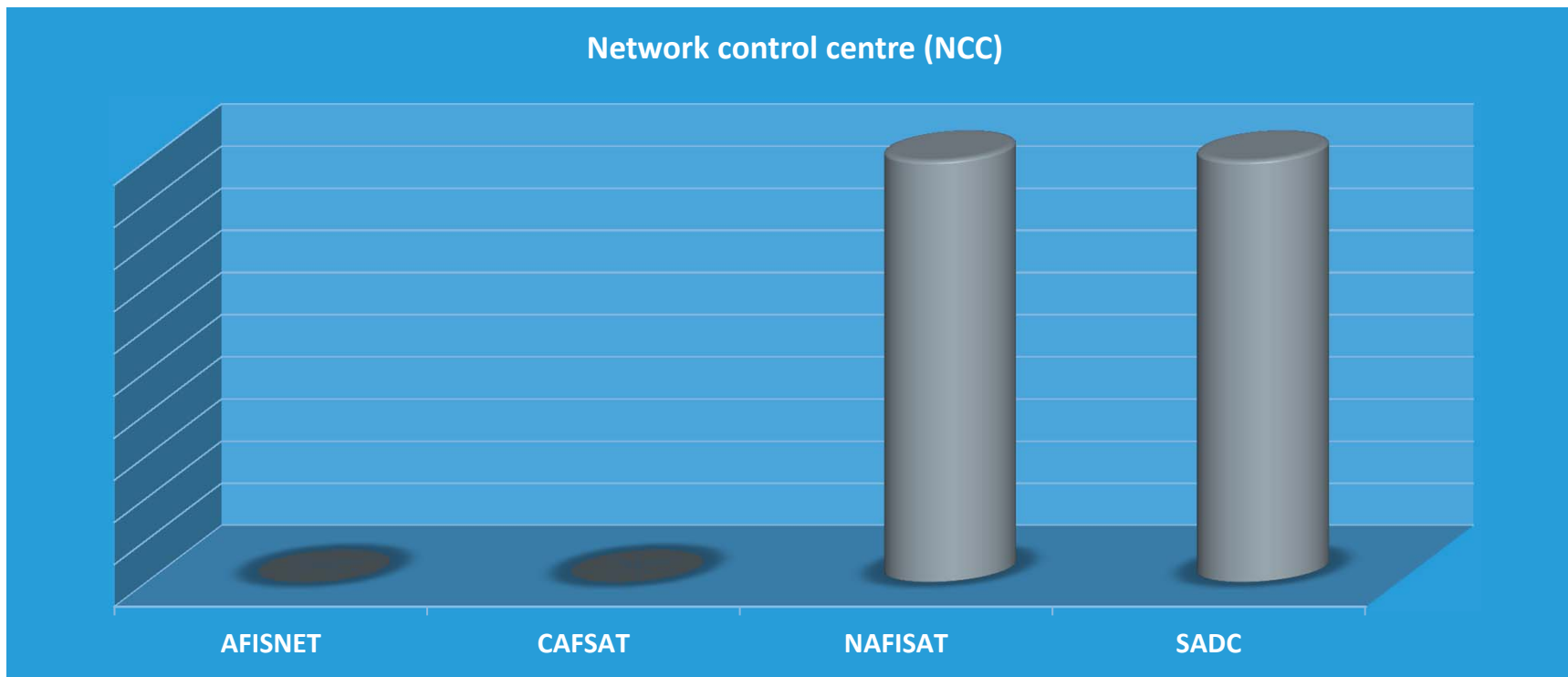
AFISNET   CAFSAT   NAFISAT   SADC
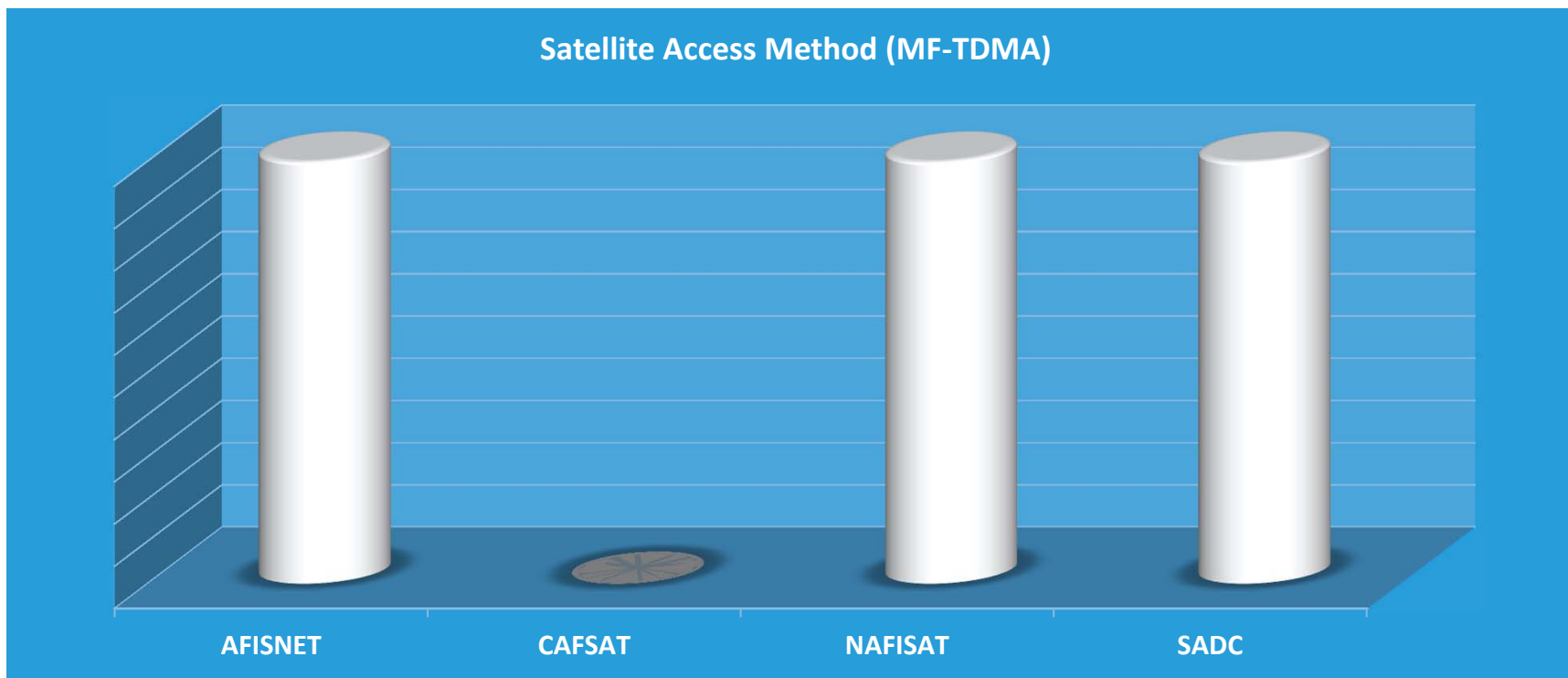
VSAT Networks – Gap Analysis

Contingency Plan (Satellite Used)

| AFISNET | CAFSAT | NAFISAT | SADC |
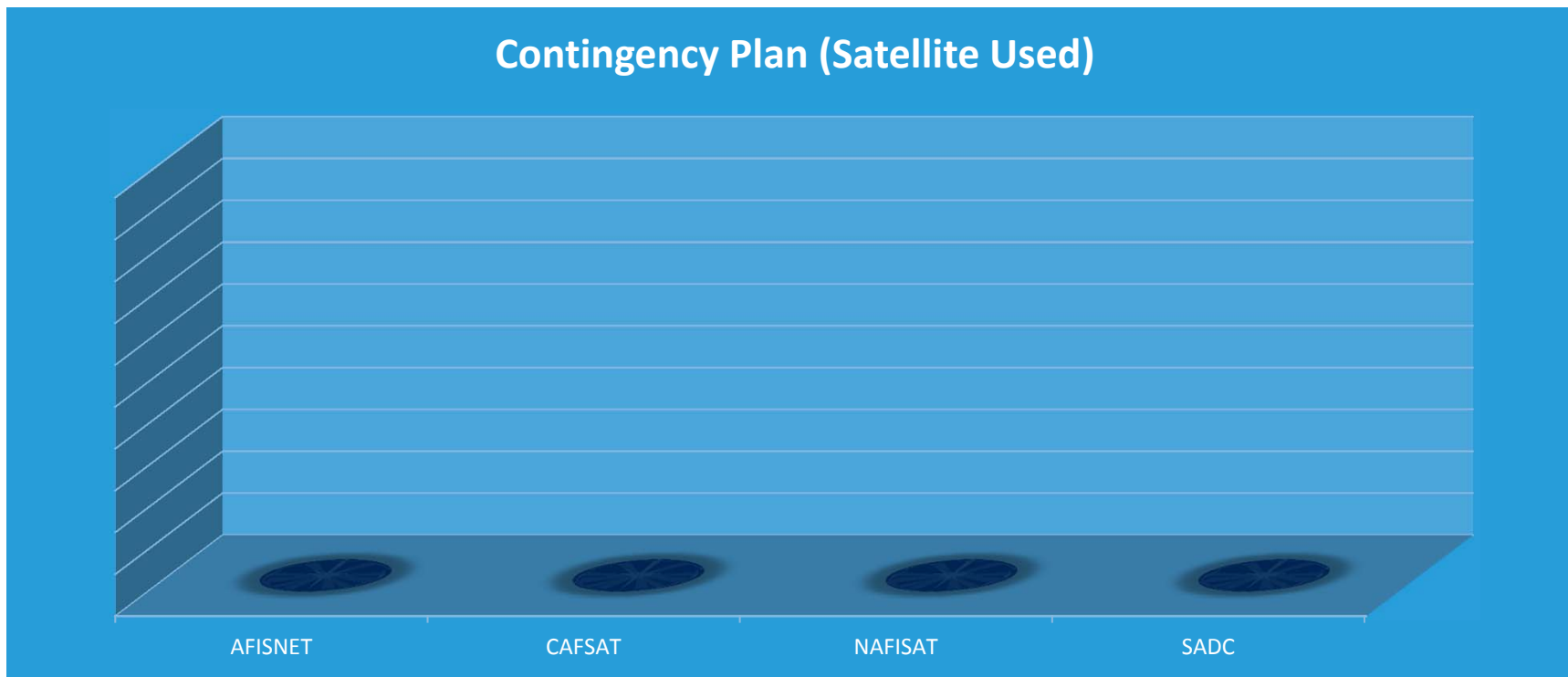
Contingency Plan (Transponder Up/Down)
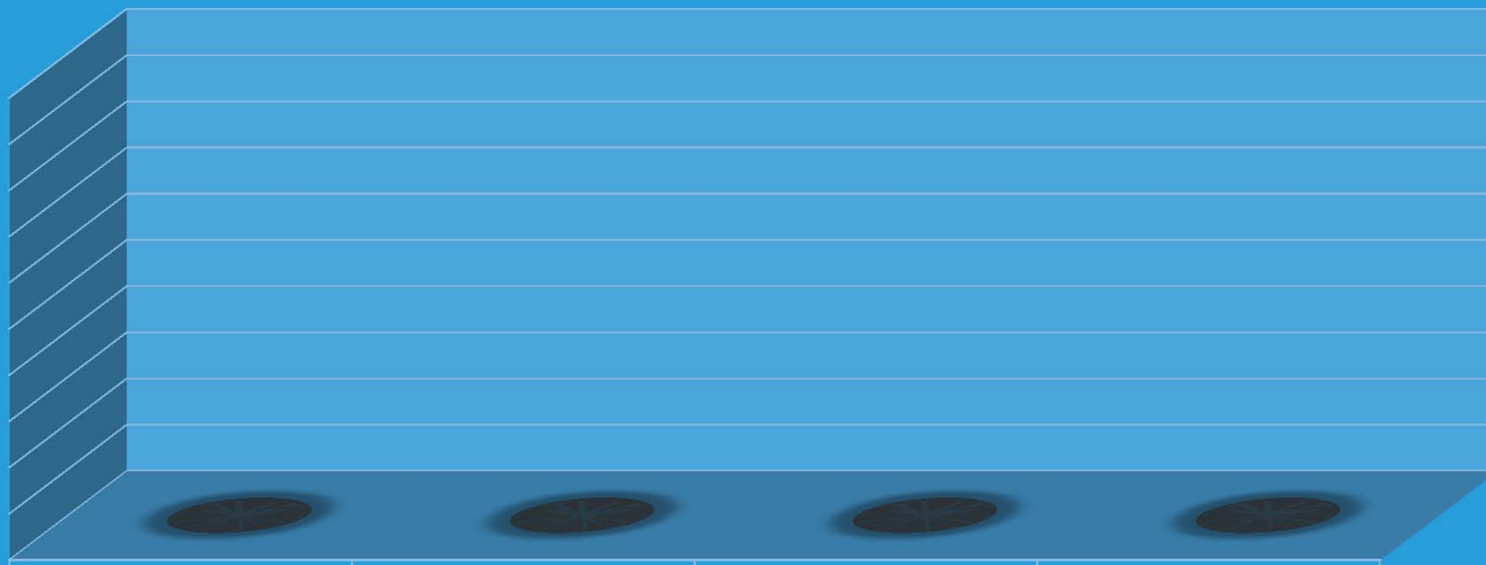
AFISNET   CAFSAT   NAFISAT   SADC

VSAT Networks – Gap Analysis

Frequency Band (ITU RR)

AFISNET   CAFSAT   NAFISAT   SADC

VSAT Networks – Gap Analysis

Frequency Band (ITU RR)

AFISNET   CAFSAT   NAFISAT   SADC
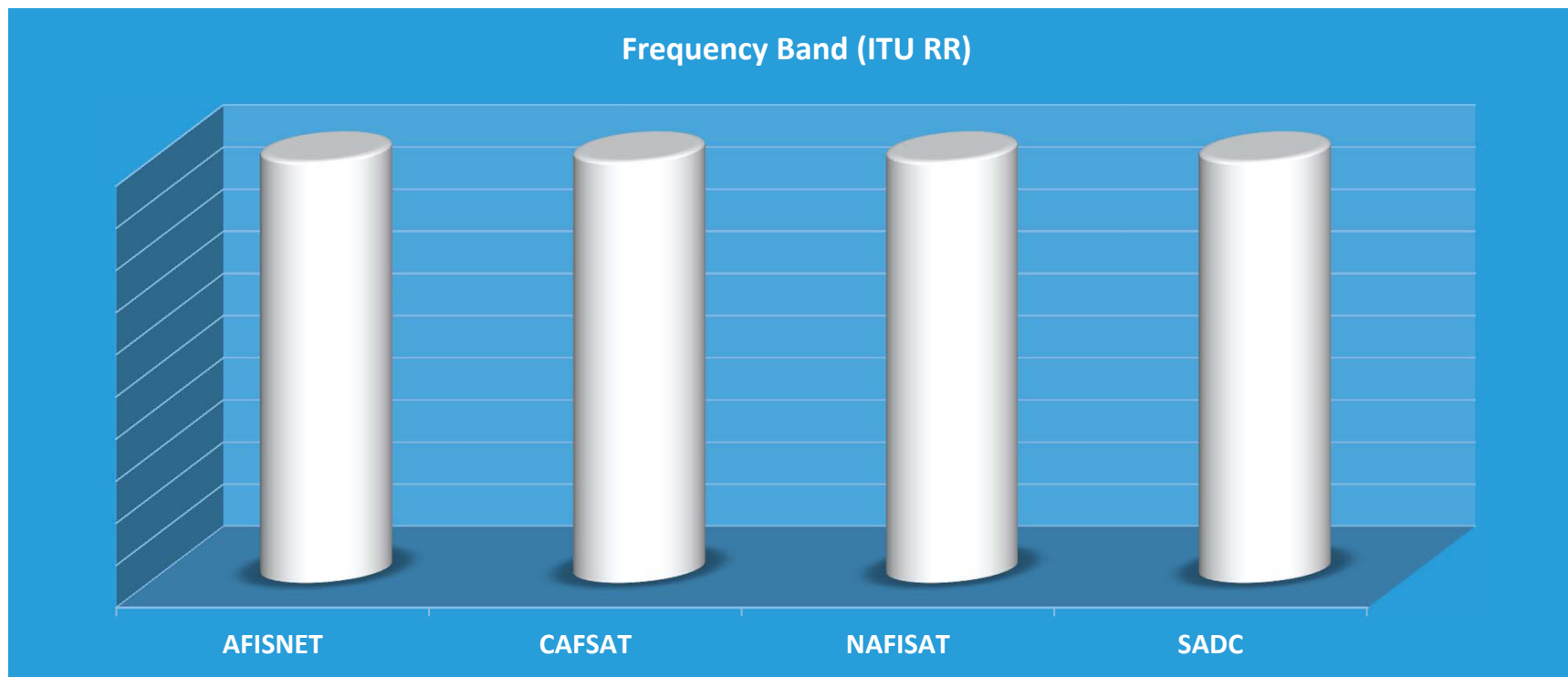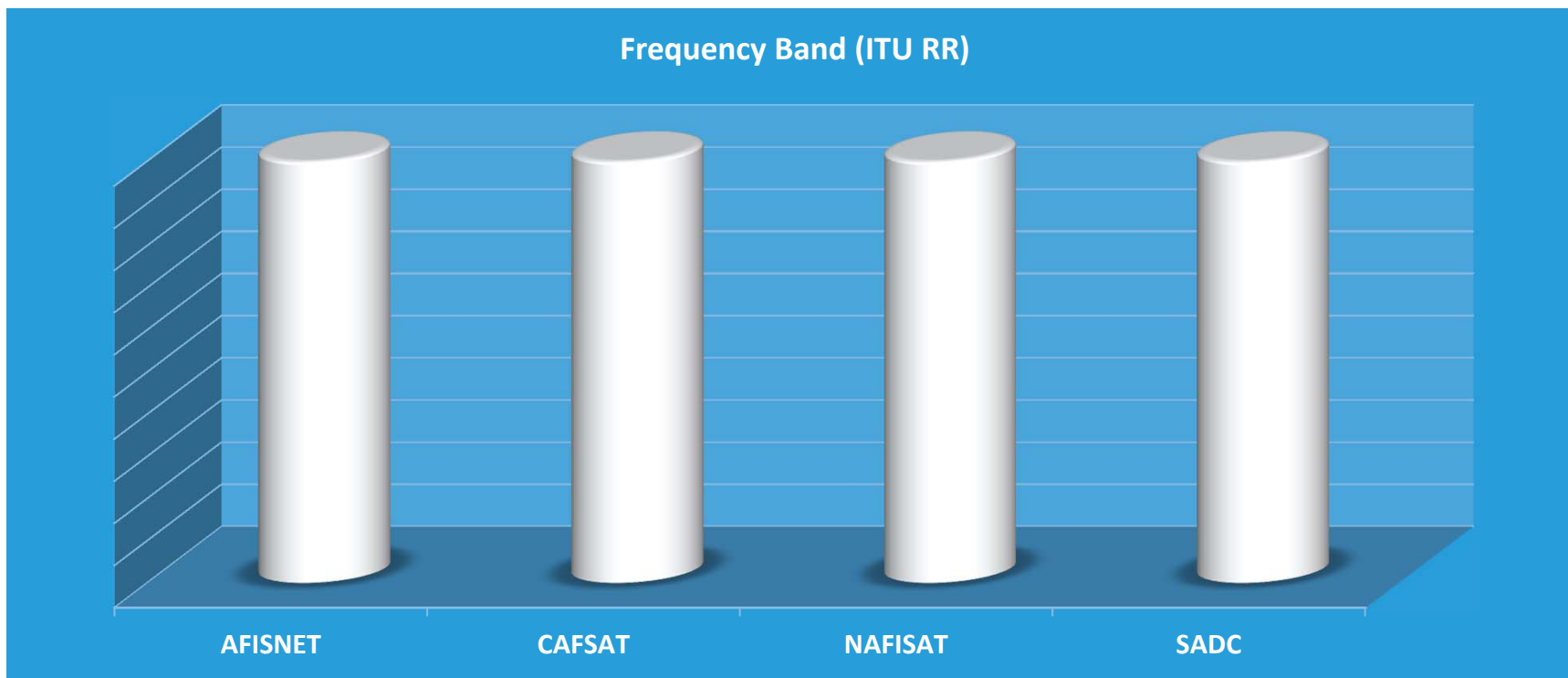
VSAT Networks – Gap Analysis

Network Topology (Meshed network)

| AFISNET | CAFSAT | NAFISAT | SADC |

VSAT Networks – Gap Analysis

Bandwidth Availability

AFISNET CAFSAT NAFISAT SADC
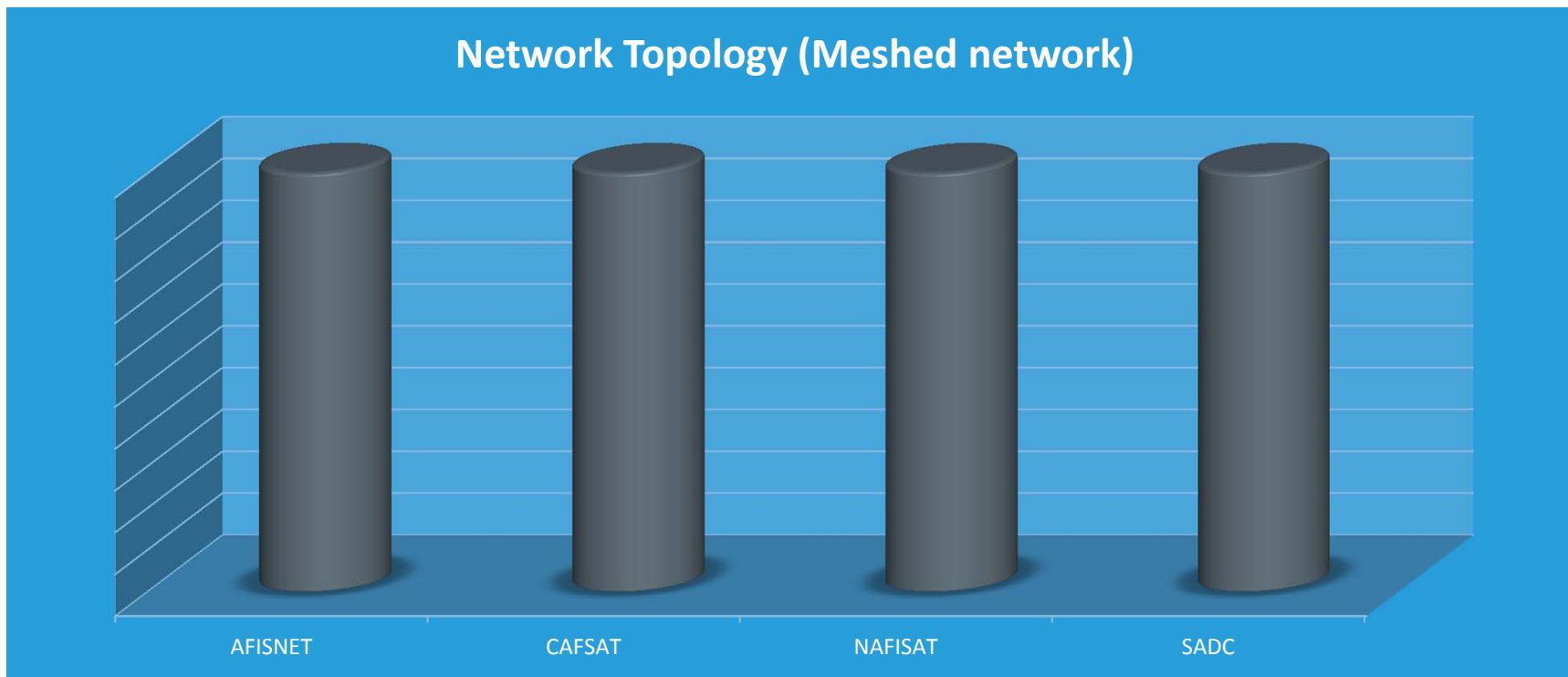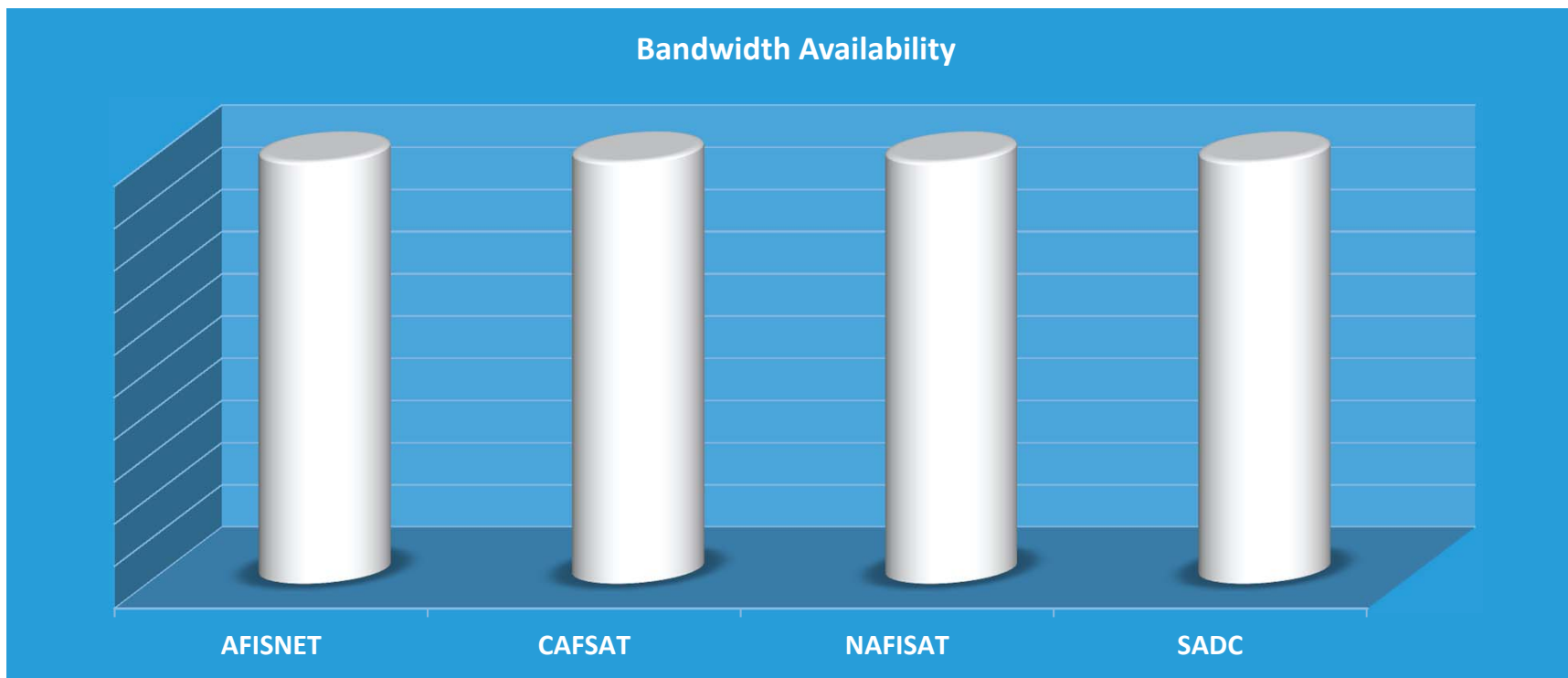
VSAT Networks – Gap Analysis

Dedicated Engineering Service Channel (Coordination of maintenance)

AFISNET   CAFSAT   NAFISAT   SADC

VSAT Networks – Gap Analysis

**Transmission Speed
(AFTN/1200 bauds)**

| AFISNET | CAFSAT | NAFISAT | SADC |

B0-FICE Implementation

Performance Improvement Areas	Block 0 (2013)	Block 1 (2019)	Block 2 (2025)	Block 3 (2031 onward)
Globally interoperable systems and data	Module B0–FICE	Module B1–FICE	Module B2–FICE	Module B3–FICE
	Performance capability: Increased interoperability, efficiency and capacity through ground-ground integration.	**Performance capability:** Increased interoperability, efficiency and capacity through FF-ICE/1 application before departure.	**Performance capability:** Improved coordination through multi-centre ground-ground integration: (FF-ICE/1 & Flight Object, SWIM).	**Performance capability:** Improved operational performance through the introduction of Full FF-ICE.

B0-FICE Module Dependencies
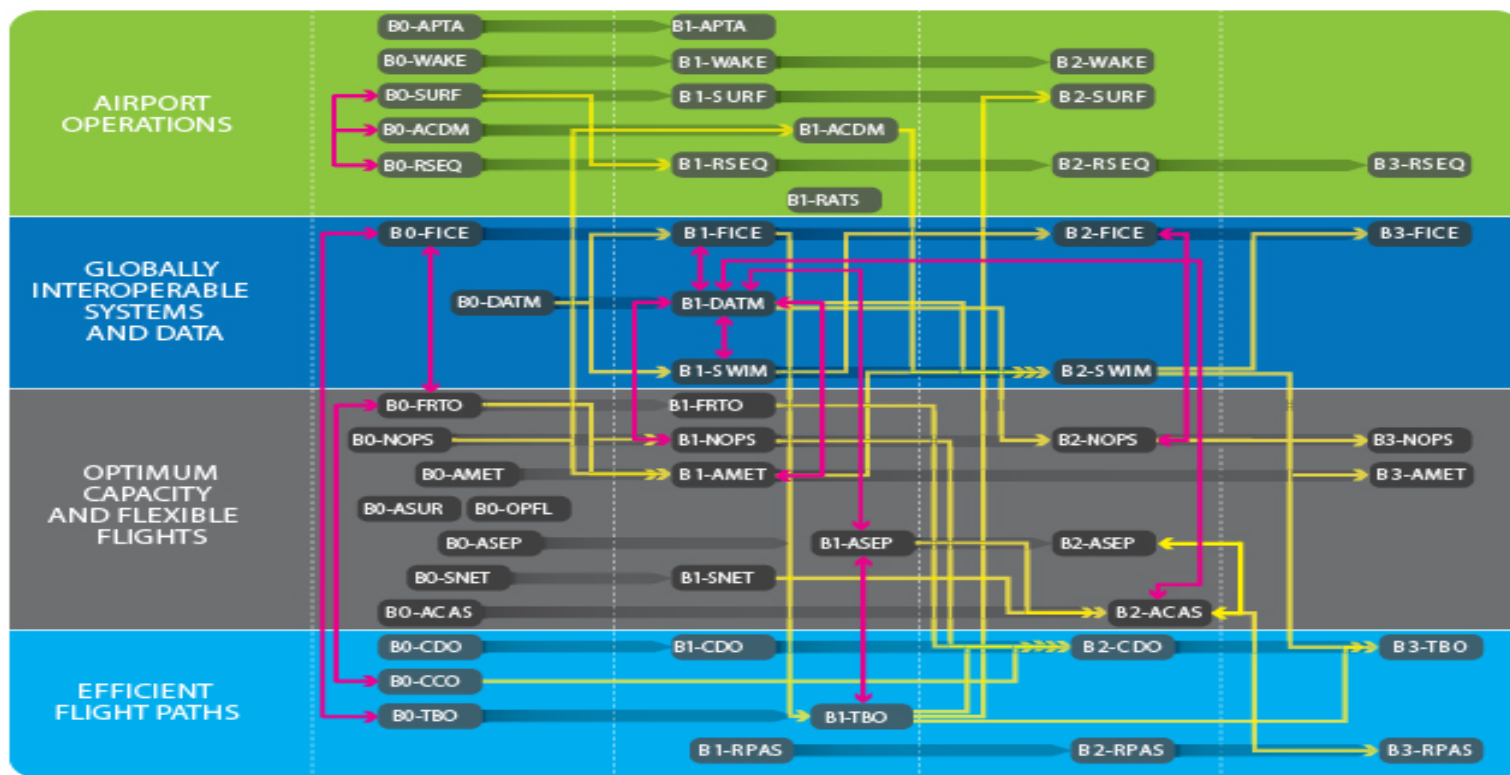
B0-FICE Implementation

- Need for Modernization/Upgrade of existing VSAT Networks
- In progress for
  - NAFISAT
  - MID VSAT
  - AFISNET
  - SADC VSAT
  - CAFSAT
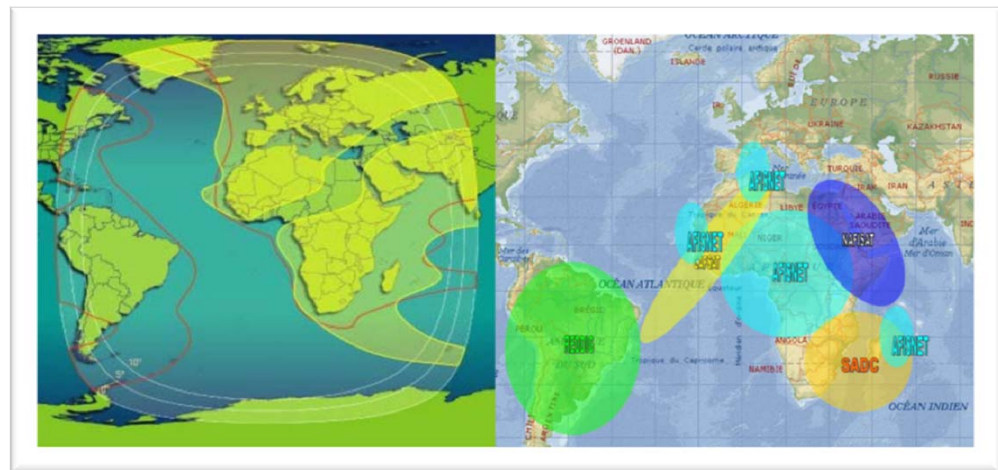
Option D-1 : TDMA - IDU7000 1 + 1 IDU
(Typical NAFISAT/SADC2 VSAT Terminal)
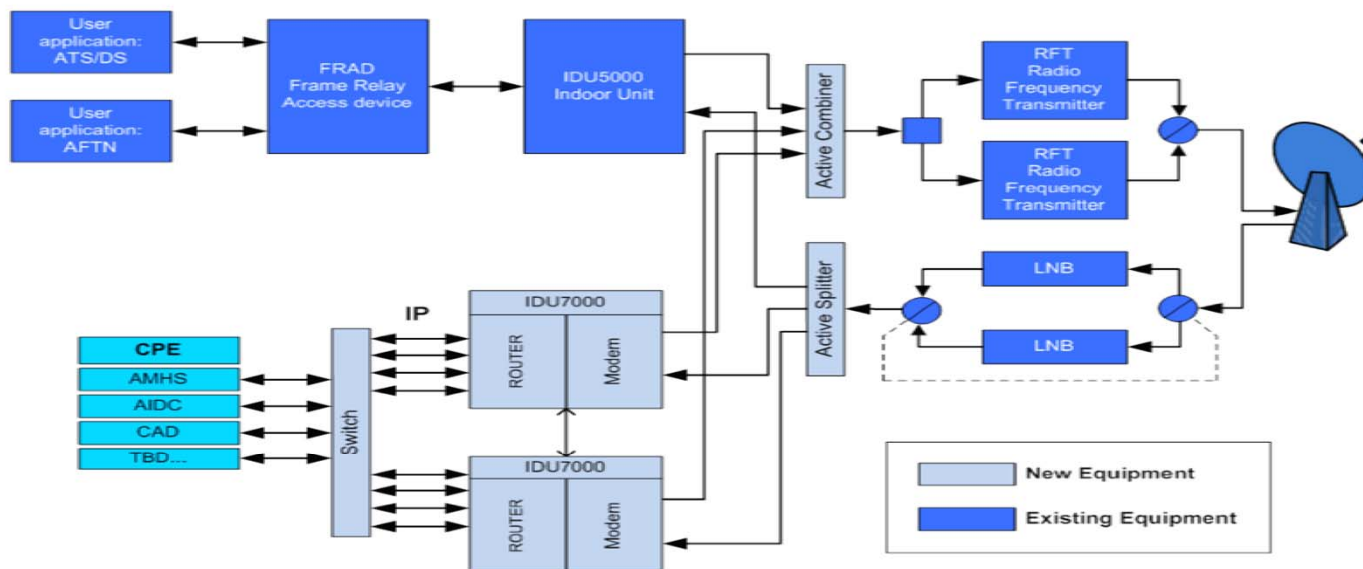
Option D-2: FDMA + TDMA Overlay: IDU7000 1+1 IDU
(Typical AFISNET VSAT Terminal)
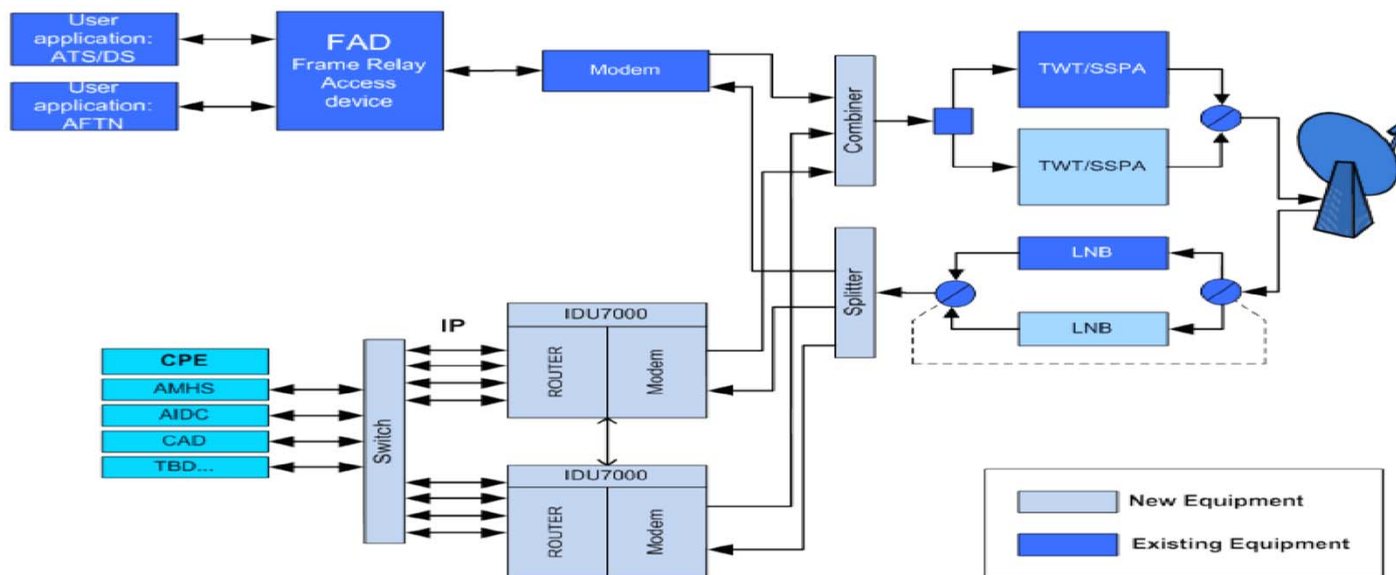
Cost calculation

Items included in the cost calculation for each network:

- RF Outdoor Equipment (SSPA where required)
- Indoor Unit
- Modem/Frame Relay Access Device
- Equipment Rack and Miscellaneous
- Uninterrupted Power Supply (UPS)
- Spare Equipment
- Site Installation, Integration and Commissioning
- Engineering, Project Management and Training
- Packing, Freight and Insurance
- Duties and Taxes

Spares options

- Options were considered:

  - Provision of one set of spare equipment for each of the 4 regions - centralized maintenance center for each network

  - Provision of one set of spares for each VSAT node - typically of what will be required for decentralized maintenance for 25 nodes

  - A hybrid maintenance setup which is a combination of above. In this case AFISNET & CAFSAT – decentralized and SADC & NAFISAT - centralized maintenance

  - The actual spares quantities are not finalized and will depend on further investigation regarding failure rates, TUT for repairs, etc.

Cost of spares options

			NAFISAT		SADC2		AFISNET		CAFSAT		Total
Option 1	One set per Region (i.e. 4 sets)	$	32,530.00	$	51,730.00	$	51,730.00	$	32,530.00	$	168,520.00
Option 2	One set per VSAT Node (i.e. 25 sets)	$	195,180.00	$	310,380.00	$	385,040.00	$	162,650.00	$	1,053,250.00
Option 3	a) One set per CAFSAT & AFISNET VSAT Node b) One Set for SADC Region c) One Set for NAFISAT Region	$	32,530.00	$	51,730.00	$	385,040.00	$	162,650.00	$	631,950.00

Comparison of Life-Cycle Cost for Options A - F over a 6 Year Period (USD)

Option D (TDMA: 1 + 1)	USD						Interest Rate =	9%
Capex (including Spares Option 3)	3,038,627.00						Period (years) =	6
Operational cost/month:								
a) Spectrum Cost	15,689.80							
b) Maintenance	TBD							

Life-cycle cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total for 5 Years
Cost of capital (9%, 6 years)	677,370.07	677,370.07	677,370.07	677,370.07	677,370.07	677,370.07	4,064,220.43
Operational cost	188,277.60	188,277.60	188,277.60	188,277.60	188,277.60	188277.6	941,388.00
						Grand Total	5,005,608.43

Notes:

1. Spares Option 3 is included i.e. One set of spares for each node in the AFISNET and CAFSAT Regions and One set of spares each for SADC and NAFISAT Regions

2. The actual spares quantities are not finalised and will depend on further investigation regarding failure rates, TUT for repairs, etc.

3. The maintenance cost must still be finalised, however assuming similar failure rates, man hours, etc. this should be not chance the outcome of the life-cycle calculations significantly.

Initial Time Frame for Modernization/Upgrades

ID	Task Name	Duration	Start	Finish
1	Time Frame for Technical Team	1437 days?	Fri 13-06-28	Mon 18-12-31
2	Revisit cost estimates & Provide input to Financial & Admin. Groups	46 days	Mon 13-07-01	Mon 13-09-02
3	Revise AFI ATN Routing Atchitecture	110 days	Mon 13-07-01	Sat 13-11-30
4	Complete work i.r.o. maintenance options	110 days	Mon 13-07-01	Sat 13-11-30
5	Review and update the status of implementation of the best practices as adopte	110 days	Mon 13-07-01	Sat 13-11-30
6	Conduct a gap analysis against agreed best practices for networks	110 days	Mon 13-07-01	Sat 13-11-30
7	Develop a convergence plan with priorities and timelines to close ider	1437 days?	Fri 13-06-28	Mon 18-12-31
8	2012 to 2014 – National deployment	393 days?	Mon 13-07-01	Wed 14-12-31
9	2013 – 2015 – Regional deployment	655 days?	Fri 13-06-28	Thu 15-12-31
10	2014 – 2018 – Inter-regional deployment	1304 days?	Wed 14-01-01	Mon 18-12-31
11	Analyze possible impact of the alignment of ANPs and SUPPs on its work	284 days	Mon 13-07-01	Thu 14-07-31

Way forward

- ## Coordinate the AFI and MID ATN Routing Architecture
    - **Taking into account the alignment of ANPs and SUPPs Applicability Areas (AFI, EUR, MID)**

- ## ATS Inter-facility Data Communications (AIDC)
    - **AIDC/OLDI to be implemented for Inter-Regional Coordination (adjacent ATSUs)**

- ## ATS Message Handling System (AMHS)
    Proposed timelines (AFI):
    - **2012 to 2014 – National deployment – domestic AMHS**
    - **2013 – 2015 - Regional deployment – AFI States will implement MTA to MTA, AMHS connections using TCP/IP via established AFI networks**
    - **2014 – 2018 – Inter-regional deployment – ATN/IPS connections**

- ## ICAO to pursue interregional coordination and harmonization of ANS towards interoperability and seamlessness
    - **Through joint initiatives (meetings, workshops, seminars) & exchange of information among Regional Offices and PIRGs**

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THANK YOU