COMPREHENSIVE ATC-SOLUTION

‘AIS – AUTOMATION‘

REQUIRED FOR THE IMPROVEMENT OF
AIR TRAFFIC CONTROL (ATC) SYSTEMS / NETWORKS
TO ENSURE AND ENHANCE
NIGERIAN AIRSPACE SAFETY

Technical Overview

Project Segments

for

AIS - AUTOMATION

in full compliance with

NAMA‘s Tender Specifications

and latest ICAO SARPs

Project Segments

NAMA's Comprehensive Solution 'AIS-AUTOMATION' comprises latest state-of-the-art Air Traffic Control Communication and Message Handling Systems / Networks for Air Traffic Controllers and Pilots (pre-flight briefing and on-route).

The new redundant ATC - MF TDMA VSAT infrastructure (SkyWAN) is a secured ICT-platform for the a.m. systems / networks and all other ATC - Applications that require highest reliability of ATC services (>99.97%).

The core project segments encompass the following ATC technologies and systems :

- **Automated centralized Aeronautical Information & Message Handling System (AIS / AMHS / AFTN) for 26 ATC-Sites and NEMA SAR HQ, Abuja, including Aeronautical Information Publishing (AIP), Mapping & Charting (MAP) and the National Obstruction/Obstacles Database.**

Project Segments *(cont.)*

- **ATC MF-TDMA SkyWAN VSAT Network operating in parallel redundancy mode via two (2) independent Communication Satellites (actually 2 complete systems to achieve >99.997% network availability) providing the most reliable and secure ATC infrastructure available, including redundant Microwave Links for the extension of the VSAT Network to other Terminals at Lagos, Kano and Abuja Int'l. Airports**

- **Uninterruptible Power Supply (UPS) Systems, as a dual (redundant) power supply for**

  all ATC VSAT and AIS / AMHS systems, with standby capacities of up to 30 hours at remote airports.

All systems are to be installed with at least 100% redundancy for >99.997% network availability.

Technical Configuration

of

'AIS – AUTOMATION'

including

Network & Layout Drawings

for the 26 Nigerian Airports,

NEMA Search & Rescue Centre, Abuja

and

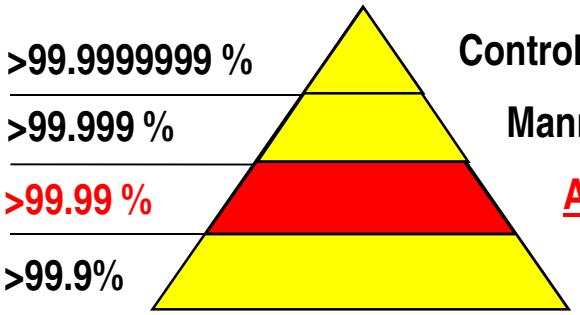
Technical Support Centre(s) in Germany

General Safety Considerations

Air Traffic Control (ATC) Systems and Networks of international standards and in full compliance with EUROCONTROL and ICAO *Standards And Recommended Practices* (SARPs), are located within the Top Range of Operational Dependability.

System / Network - Availability

Required Safety Thresholds:



Control Systems of Atomic Power Plants

Manned Space Systems, Commercial Aircraft's Radio System

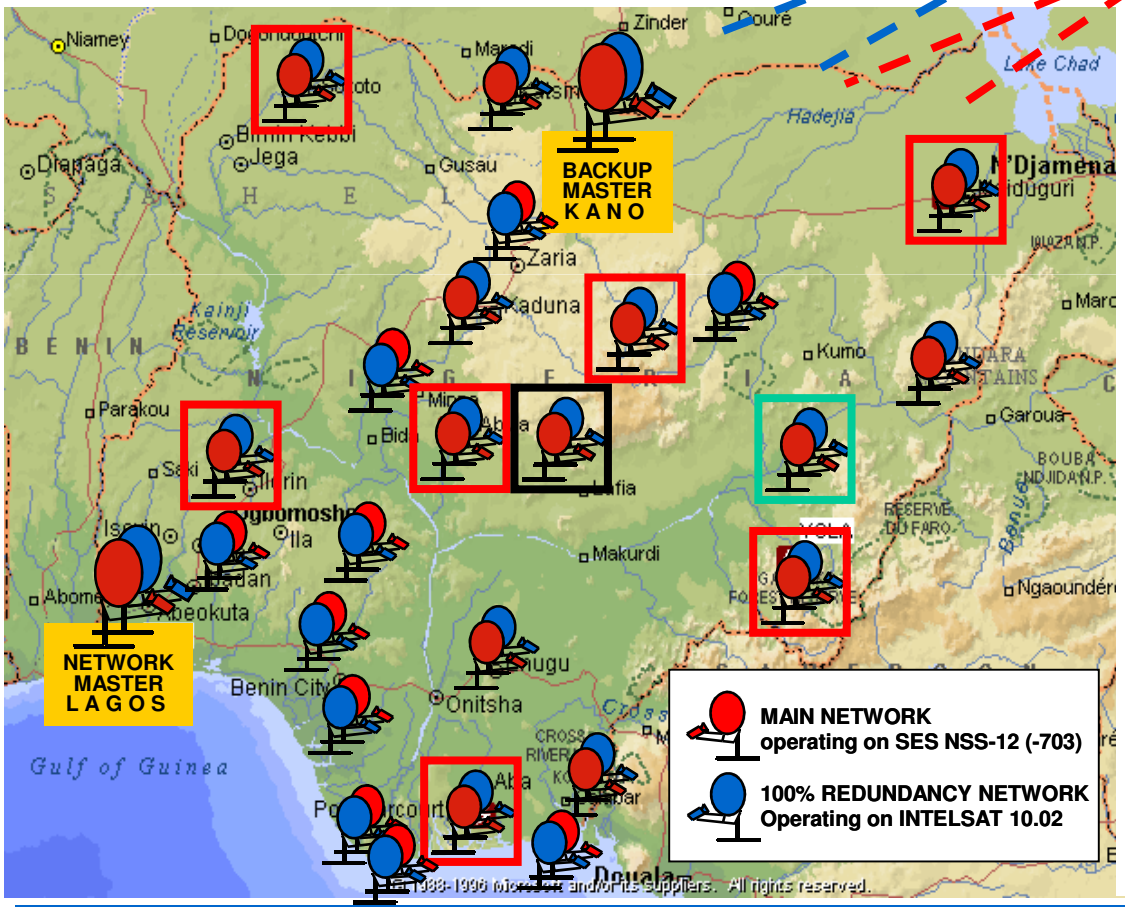
Air Traffic Control Systems, Hospital Surgeries

Air Traffic Navigation Systems,

Highest-Reliability ATC VSAT Network for all ATC-Services

Availability Rate: 99.997%

Redundant *Sky*WAN® MF-TDMA VSAT-Network for 26 Sites and NEMA SAR Centre, Abuja, contained in the AIS-AUTOMATION Project



INTELSAT 10.02

SES ASTRA (NSS-703) NSS-12

ATM (AFTN) Gateway. Network Support Centre Ludwigsburg, Germany

Legend :

- **2 Area Control Centres (ACC)**
  LAGOS, KANO
- **7 Airports with ACC Ground-to-Air ER VHF Repeater Stations**
  ABUJA, PORT HARCOURT, ILORIN, JOS, SOKOTO, MAIDUGURI, BEBI,
- **1 Non-Airport ER VHF Repeater Site**
  WUKARI
- **7 Airports with low Traffic**
  CALABAR, OSUBI, ENUGU, KATSINA KADUNA, OWERRI, YOLA
- **9 Airports with very low Traffic**
  IBADAN, BENIN, MINNA, BAUCHI, AKURE, ZARIA, EKET, BONNY, ESCRAVOS
- **NEMA Search & Rescue (SAR) Centre, ABUJA**

SkyWAN Network Configuration

LAGOS Int'n. Airport Layout

Parallel Operation Mode – Hot Redundancy
No-Single-Point-of-Failure

PABX(s)
LAN(s)
Airlines
etc.

RADAR,
MET,
AFTN

FADs
9230

FAD-E
8400

IDU
7000

FAD 1

RX
L – Band
TX
FPS

D.- Conv.
LNB

INTELSAT
10.02

SES ASTRA
(NSS 703)
NSS-12

C – Band
Antenna 1

BUC SSPA 60W

IDU
7000

FADs
9230

FAD-E
8400

FAD 1a

C – Band
Antenna 2

ATS -
DS

VHF-RCAG
ACC - VCCS

AIS
AMHS

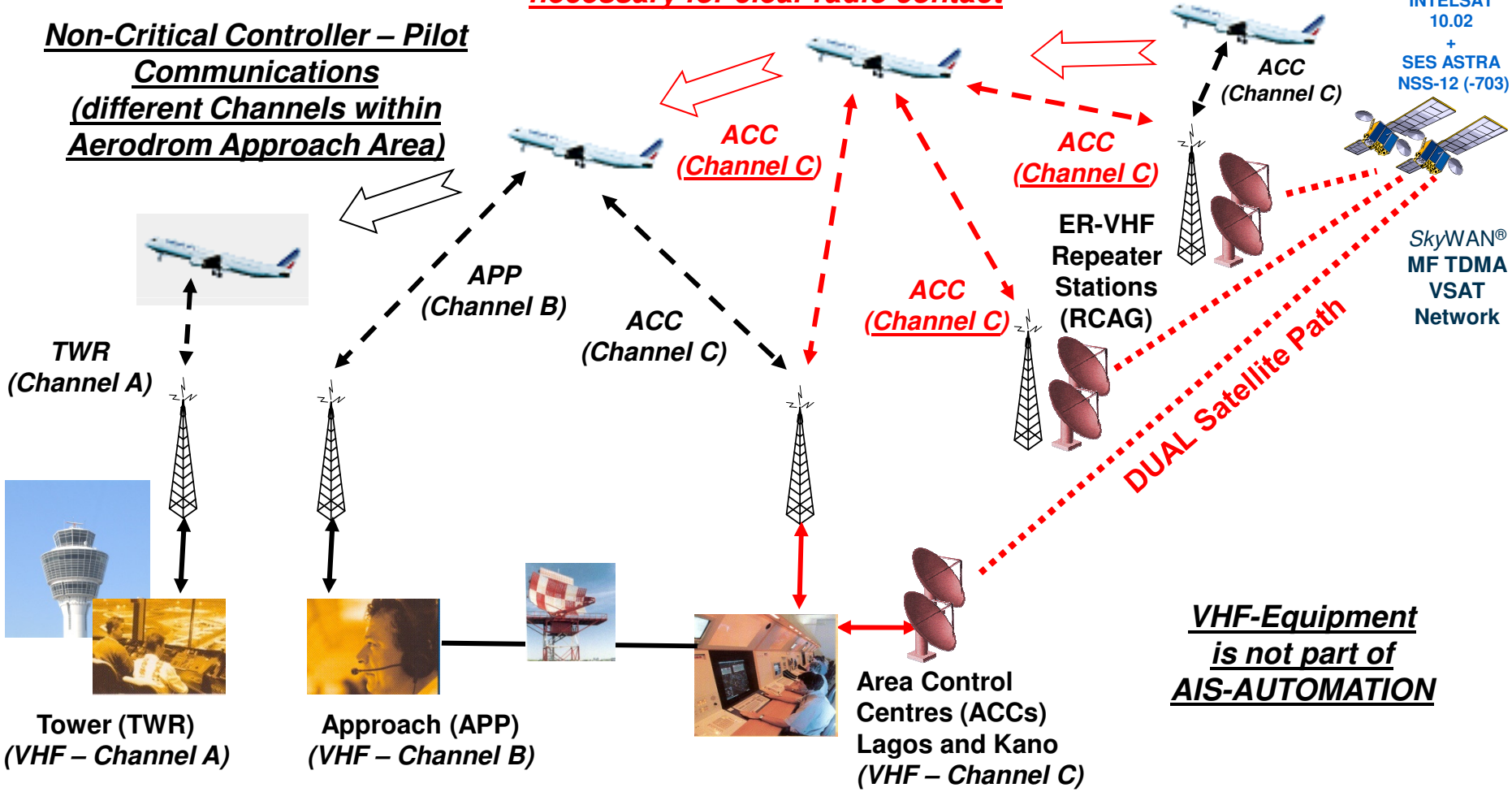
100% Redundant
MF-TDMA *Sky*WAN®
VSAT- Network

>99.997%
Network Availability
in accordance with ICAO SARPs

Controller – Pilot Communications

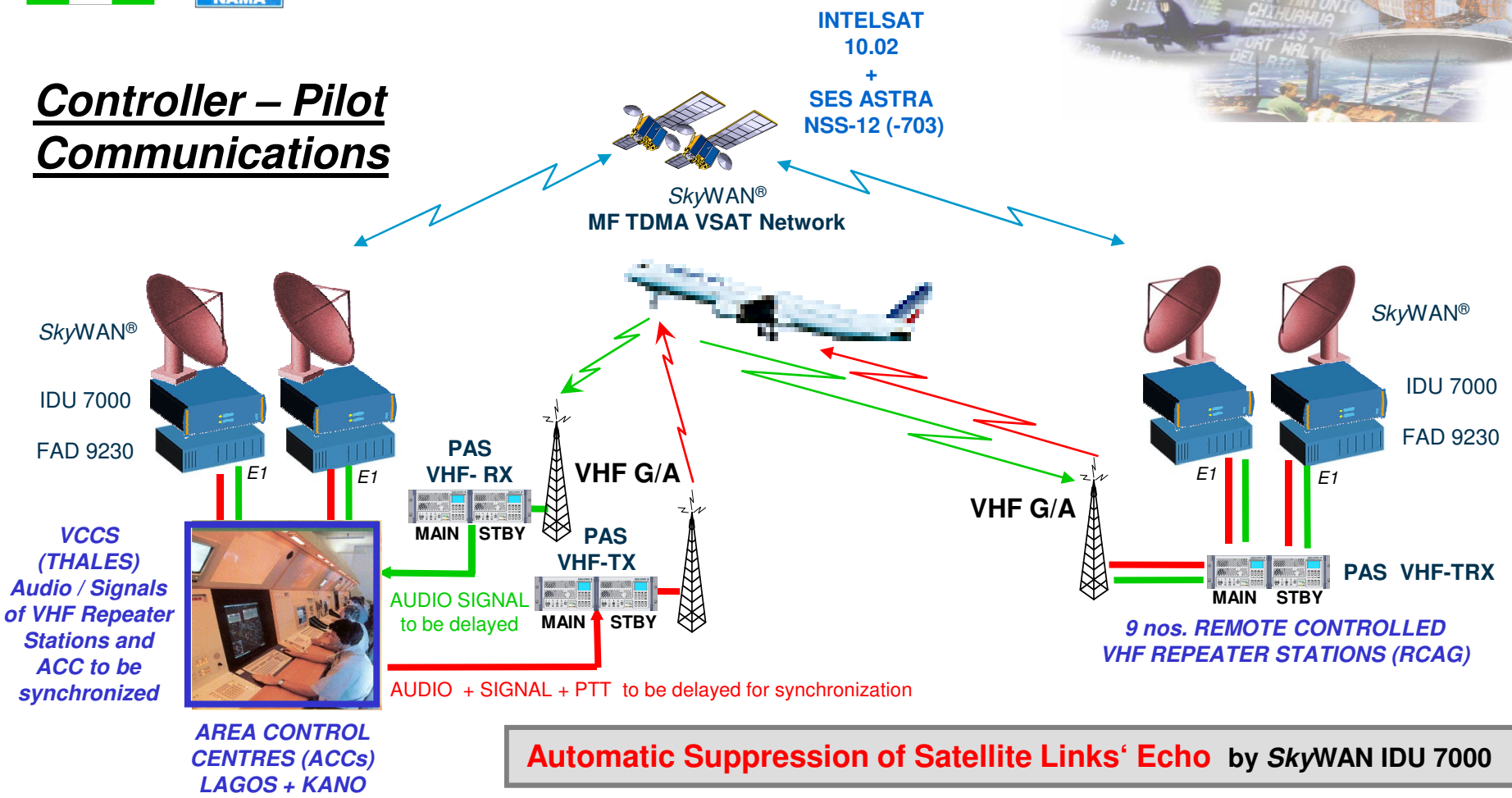
Critical ACC Controller – Pilot Communications (same Channel simultaneously transmitted by more than 1 Repeater Station, therefore ECHO SUPPRESSION necessary for clear radio contact

Non-Critical Controller – Pilot Communications (different Channels within Aerodrom Approach Area)



VHF-Equipment is not part of AIS-AUTOMATION

Controller – Pilot Communications



Automatic Suppression of Satellite Links' Echo by *Sky*WAN IDU 7000

Suppression of Delay - Echo by synchronization of VHF Systems at ACC

Eradication of ‚Blank Spots' by new VHF Repeater Station(s)

VHF-Equipment is not part of AIS-AUTOMATION

Redundant ACC ER - Links Configuration (RCAG)

SkyWAN®
Support Centre
Ludwigsburg,
Germany

SkyNet TECHNICAL HOTLINES

INTERNET

FAD 9230 IDU 7000

Sokoto

ER – ACC KANO
WESTER ZONE
- F1 – ACC W.
- F2 - ACC W.
- DISTRESS 121.5 MHz

VHF RCAG — SkyWAN® — FAD 9230 IDU 7000

Jos, Maiduguri, Bebi, Wukari

ER – ACC KANO
EASTER ZONE
- F1 – ACC E.
- F2 - ACC E.
- DISTRESS 121.5 MHz

VHF RCAG — SkyWAN® — FAD 9230 IDU 7000

Ilorin, Port Harcourt Int'l. Airport

ER – ACC LAGOS
- F1 – ACC
- F2 - ACC
- DISTRESS 121.5 MHz

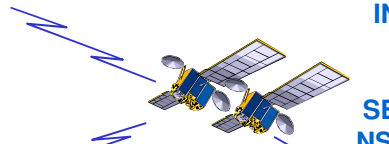
VHF RCAG — SkyWAN® — FAD 9230 IDU 7000

ER – ACC KANO
WESTER ZONE
- F1 – ACC W.
- F2 - ACC W.
- DISTRESS 121.5

ER – ACC LAGOS
- F1 – ACC
- F2 - ACC

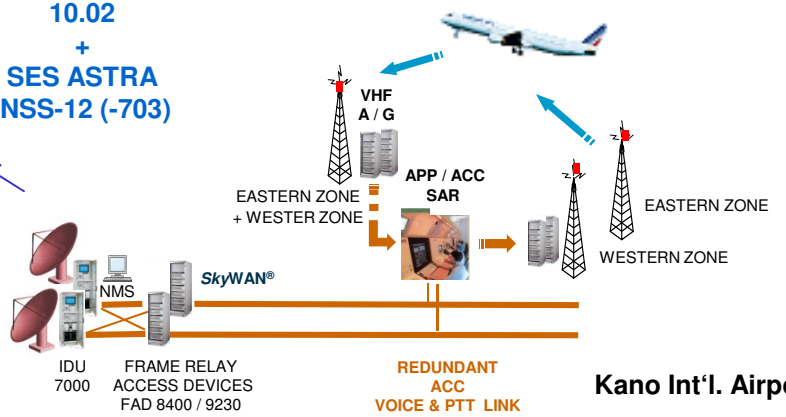
Int'l. Airport Abuja

VHF RCAG — VHF RCAG — SkyWAN® — FAD 9030 IDU 7000

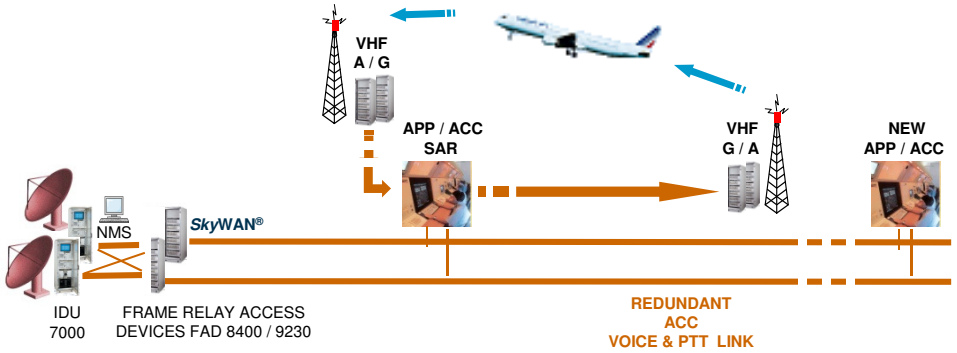


INTELSAT 10.02 + SES ASTRA NSS-12 (-703)

SkyWAN®
MF TDMA VSAT Network



Kano Int'l. Airport



Lagos Int'l. Airport

VHF-Equipment is not part of AIS-AUTOMATION

Direct Links between Controllers
Redundant ATS – DS Configuration

NEMA
SAR-Centre Abuja

SkyWAN®
FAD 9230
IDU 7000

9 Airports with very low Traffic Volume

TWR

SkyWAN®
FAD 9230
IDU 7000

Ilorin, Jos Sokoto, Maiduguri, Bebi, Yola, Katsina Calabar, Osubi, Enugu, Kaduna, Owerri

TWR

SkyWAN®
FAD 9230
IDU 7000

Abuja Int'l. Airpor

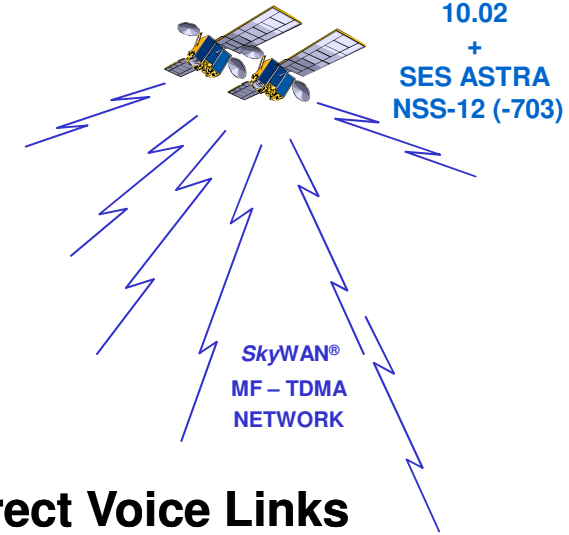
and

TWR

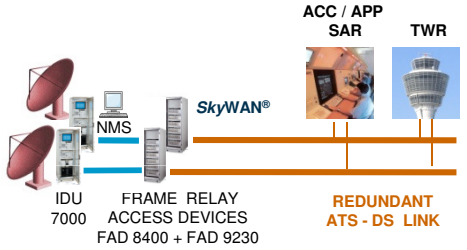
APP

SkyWAN®
FAD 8400/9230
IDU 7000

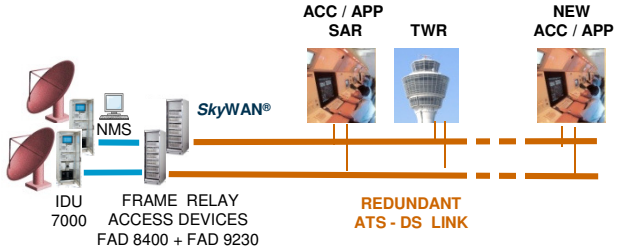
Port Harcourt Int'l. Airport



Direct Voice Links between Controllers ‚Any-to-Any Controler' and also between any Controller and NEMA SAR Centre



Kano Int'l. Airport



Lagos Int'l. Airport

Redundant AIS / AMHS / AFTN
Complete Network - Configuration

Support Centre, Ludwigsburg, Germany
INTERNET
AMHS AIS W A N
GATEWAY
SkyWAN®

NEMA SAR-Centre Abuja
AMHS AIS W A N
SkyWAN®

9 Airports with low Traffic Volume
TWR
FIC AIS
AMHS AIS W A N
SkyWAN®

Maiduguri, Jos, Sokoto, Yola, Bebi, Ilorin, Katsina, Owerri, Calabar, Osubi, Enugu, Kaduna,
TWR
FIC AIS
AMHS AIS W A N
SkyWAN®

APP
AFTN AIS
TWR
FIC AIS
AMHS AIS W A N
SkyWAN®
Port Harcourt Int'l. Airport

FIC AIS
MW Links
AFTN AIS
APP
TWR
FIC AIS
AMHS AIS W A N
SkyWAN®
INT'L. TERMINAL BUILDUNG
DOMESTIC TERMINAL
Abuja Int'l. Airport

INTELSAT 10.02 +
SES ASTRA NSS-12 (-703)

SkyWAN®
MF – TDMA NETWORK

INT'L. AFTN LINKS WITH:
- LIBREVILLE, DOUALA
- ACCRA, BRAZZAVILLE
- N'DJAMENA, NIAMEY

AIS / AMHS / AFTN STANDBY CENTRAL SERVERS & DATABASES
AIS WOS
AFTN / AIS CENTRE
MET CENTRE
APP / ACC SAR
TWR
NMS
SkyWAN®
MW Links
REDUNDANT AMHS / AIS L A N
FIC AIS
FIC AIS
DOMESTIC TERMINAL
Kano Int'l. Airport

INT'L. AFTN LINKS WITH:
- LIBREVILLE
- DOUALA
- ACCRA

AFTN / AMHS / AIS MAIN CENTRAL SERVERS & DATABASES
AIS WOS
AFTN / AIS CENTRE
MET CENTRE
APP / ACC SAR
TWR
NMS
SkyWAN®
MW Links
MW Links
REDUNDANT AMHS / AIS L A N
FIC AIS
MMIA
FIC AIS
MMA2
FIC AIS
GENERAL AVIATION TERMINAL
AFTN / AIS
AIP
MAPPING & CHARTING
NAMA HQ
Lagos Int'l. Airport

Redundant AIS / AMHS / AFTN Configuration

INTELSAT
10.02
+
SES ASTRA
NSS-12 (-703)

SkyWAN®
MF – TDMA
NETWORK

Redundant AIS / AMHS / AFTN Network

INT'L. AFTN SCPC LINKS with:

- LIBREVILLE
- DOUALA
- ACCRA

AIS / AMHS / AFTN Airport - Layout

AIS / AMHS / AFTN
MAIN CENTRAL
SERVERS
&
DATABASES

INTERNATIONAL TERMINAL

AIS WOS | AFTN / AIS CENTRE | MET CENTRE | APP / ACC SAR | TWR | NEW APP / ACC

NMS

SkyWAN®

REDUNDANT
AMHS / AIS
L A N

MW Terminal

REDUNDANT
MICROWAVE LINKS

FLIGHT
INFORMATION
CENTRE (FIC)
MMIA

MW Terminal
FIC
MMA2

MW Terminal
FIC
GENERAL
AVIATION
TERMINAL

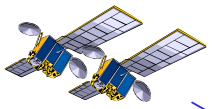
MW Terminal
AFTN / AIS | AIP | MAPPING & CHARTING
NAMA
HEADQUARTERS

REDUNDANT
AFTN
AMHS
AIS
L A N

Murtala Muhammed
Int'l. Airport LAGOS

Redundant AIS / AMHS / AFTN Network Configuration

INTELSAT
10.02
+
SES ASTRA
NSS-12 (-703)



SkyWAN®
MF – TDMA
NETWORK

Redundant AIS / AMHS / AFTN Network

INT'L. AFTN SCPC LINKS with:

- LIBREVILLE, DOUALA
- ACCRA, BRAZZAVILLE
- N'DJAMENA, NIAMEY

AIS / AMHS / AFTN Airport - Layout

AIS / AMHS / AFTN
STANDBY CENTRAL
SERVERS
&
DATABASES

INTERNATIONAL TERMINAL

AIS WOS | AFTN / AIS CENTRE | MET CENTRE | TWR | APP / ACC SAR

REDUNDANT AMHS / AIS L A N

NMS

SkyWAN®

MW Terminal

REDUNDANT MICROWAVE LINK

FLIGHT INFORMATION CENTRE (FIC)

Mallam Aminu Kano Int'l. Airport KANO

MW Terminal

REDUNDANT AMHS / AIS L A N

FLIGHT INFORMATION CENTRE (FIC)

DOMESTIC TERMINAL

Redundant AIS / AMHS / AFTN Network Configuration

INTELSAT
10.02
+
SES ASTRA
NSS-12 (-703)

SkyWAN®
MF – TDMA
NETWORK

AIS / AMHS / AFTN
STANDBY
CENTRAL
SERVERS &
DATABASES

Kano
Int'l. Airport

SkyWAN®

AIS / AFTN / AMHS
CENTRE

SkyWAN®

AIS / AMHS / AFTN
MAIN
CENTRAL
SERVERS &
DATABASES

AIS / AFTN / AMHS
CENTRE

Lagos
Int'l. Airport

AIS / AMHS / AFTN Airport - Layout

DOMESTIC TERMINAL

AFTN / AIS CENTRE
MET CENTRE
TWR
APP SAR

SkyWAN®

REDUNDANT
AMHS / AIS
L A N

MW Terminal

REDUNDANT
MICROWAVE LINK

FLIGHT INFORMATION
CENTRE (FIC)

Nnamdi Azikiwe
Int'l. Airport
ABUJA

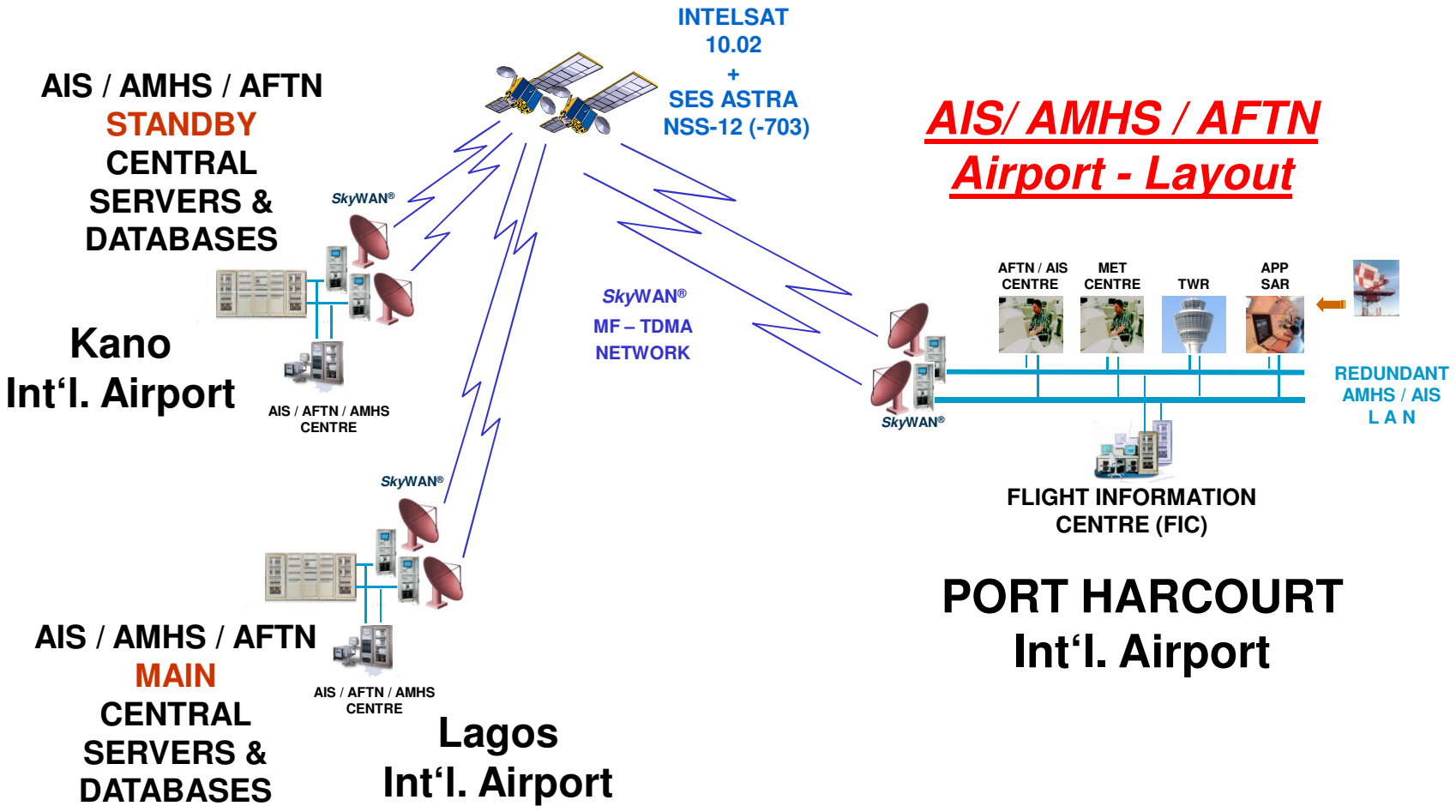
MW Terminal

REDUNDANT
AMHS / AIS
L A N

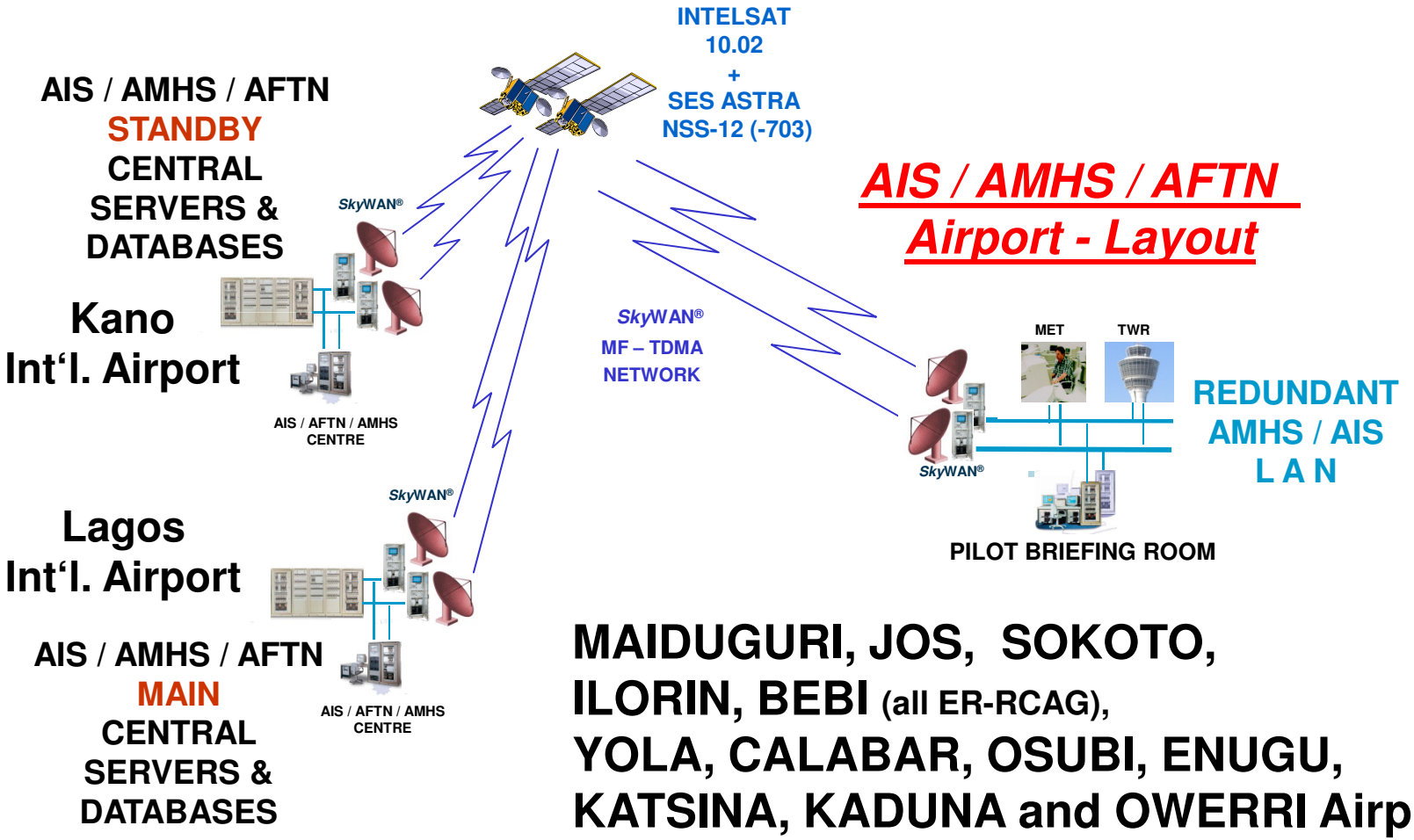
FLIGHT INFORMATION
CENTRE (FIC)

INTERNATIONAL
TERMINAL

Redundant AIS / AMHS / AFTN Network Configuration



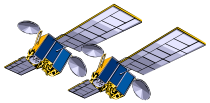
Redundant AIS / AMHS / AFTN Network Configuration



MAIDUGURI, JOS, SOKOTO,
ILORIN, BEBI (all ER-RCAG),
YOLA, CALABAR, OSUBI, ENUGU,
KATSINA, KADUNA and OWERRI Airports

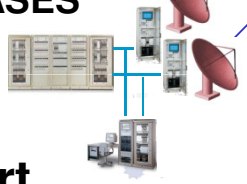
Redundant AIS / AMHS / AFTN Network Configuration

INTELSAT
10.02
+
SES ASTRA
NSS-12 (-703)



AIS / AMHS / AFTN
STANDBY
CENTRAL
SERVERS &
DATABASES

SkyWAN®



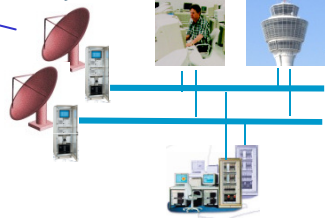
Kano
Int'l. Airport

AIS / AFTN / AMHS
CENTRE

SkyWAN®
MF – TDMA
NETWORK

AIS / AMHS / AFTN
Airport - Layout

SkyWAN®



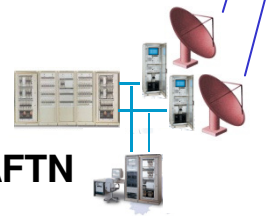
MET

TWR

REDUNDANT
AMHS / AIS
L A N

PILOT BRIEFING ROOM

SkyWAN®



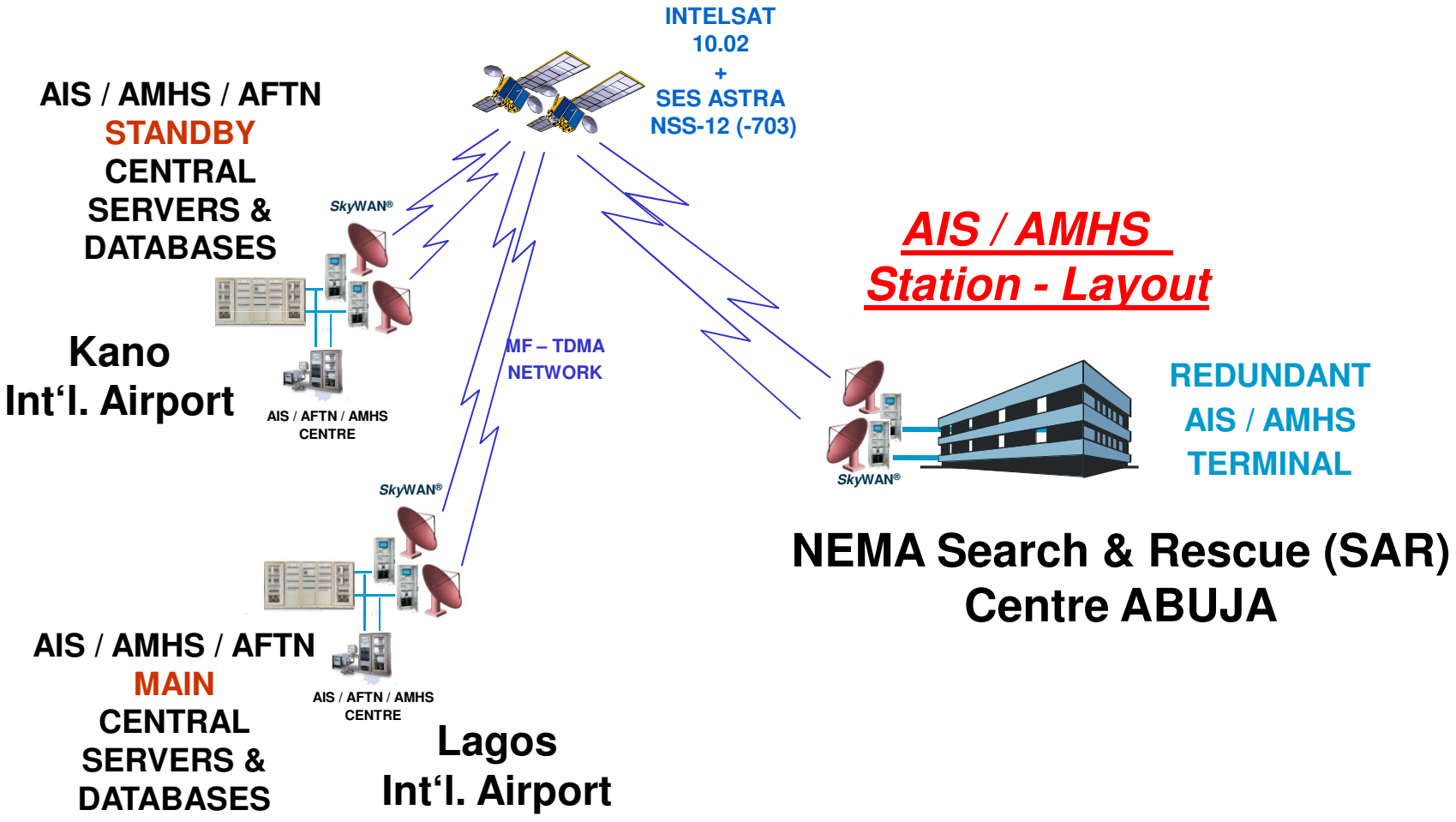
AIS / AMHS / AFTN
MAIN
CENTRAL
SERVERS &
DATABASES

AIS / AFTN / AMHS
CENTRE

Lagos
Int'l. Airport

Nine (9) Airports / Airstrips
with very low Traffic Volume

Redundant AIS / AMHS Network Configuration



Redundant AIS / AMHS / AFTN Network Configuration, Internet Gateway & SkyNet Support Centre(s) in Germany

INTELSAT
10.02
+
SES ASTRA
NSS-12 (-703)

AIS / AMHS / AFTN Gateway - Layout

AIS / AMHS / AFTN
STANDBY
CENTRAL
SERVERS &
DATABASES

SkyWAN®

Kano
Int'l. Airport

AIS / AFTN / AMHS
CENTRE

SkyWAN®

AIS / AMHS / AFTN
MAIN
CENTRAL
SERVERS &
DATABASES

AIS / AFTN / AMHS
CENTRE

Lagos
Int'l. Airport

MOCOM - SkyNet Partner's 24 hrs. / 7 days
TECHNICAL & OPERATIONAL SUPPORT
HOTLINES

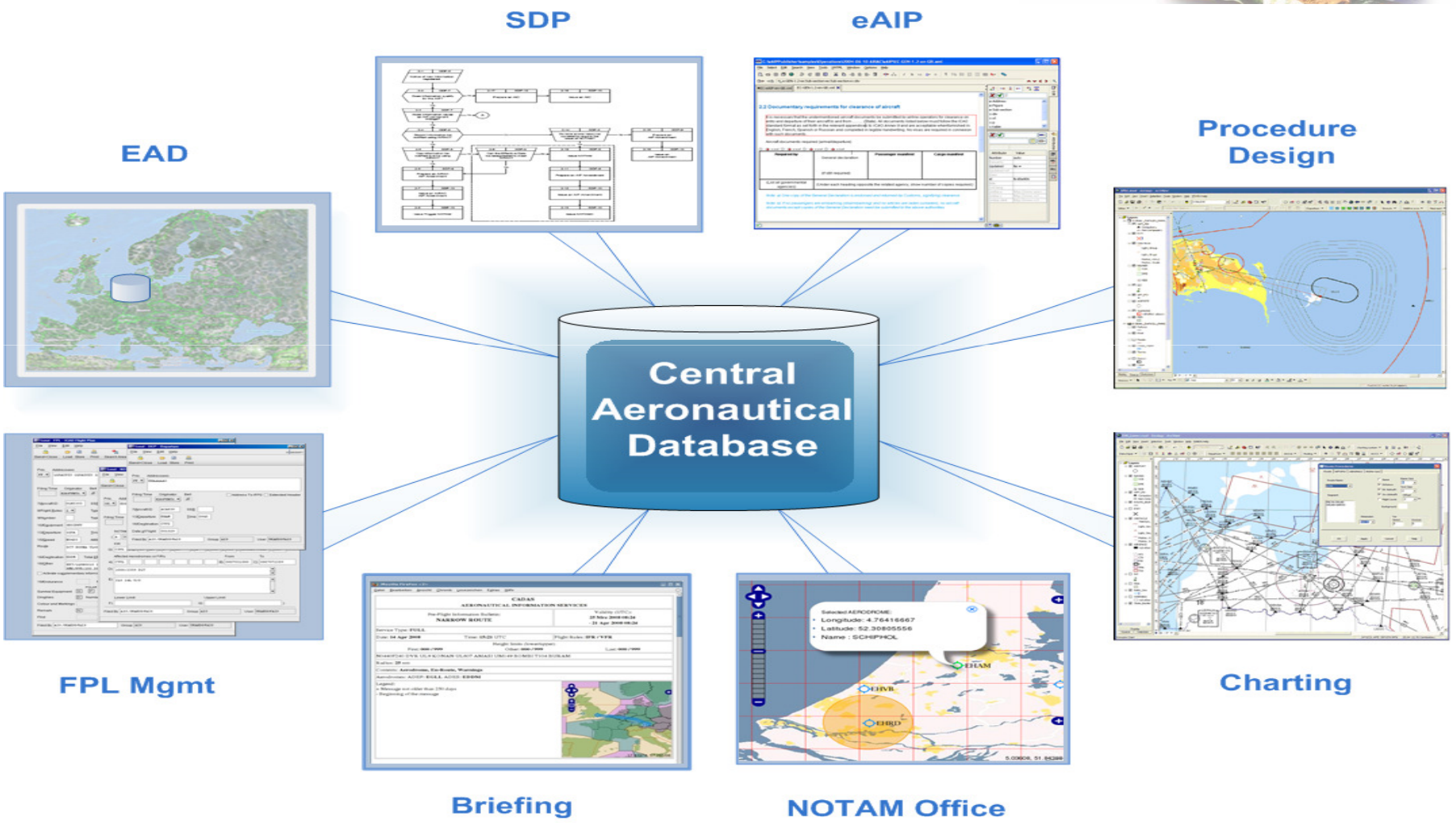
INTERNET

REDUNDANT
NETWORK
GATEWAY
IN GERMANY

Nigerian AIS - AUTOMATION
Pre-Flight Information
obtainable globally via
reliable Internet - Interface

***MOCOM - SkyNet* Support Centre**
Ludwigsburg, Germany

Integrated AIM solution in NAMA.



AIM Components

Central Aeronautical AIXM (latest version)Database

IMS

- TAM/MET office
- Briefing
- Web server
- Document server
- Integrated HMI server

ATS

- FPL Management

AIP

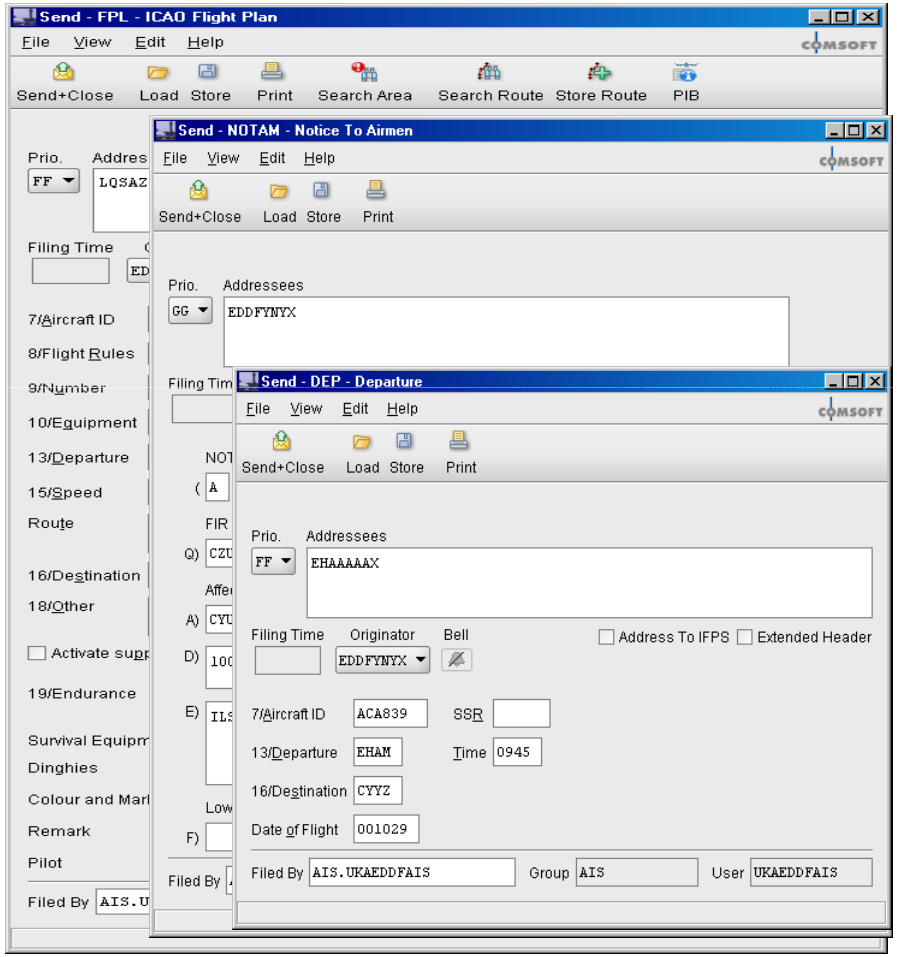
- ICAO and EUROCONTROL compliant eAIP

Charting Sub-System

- Aeronautical Charting

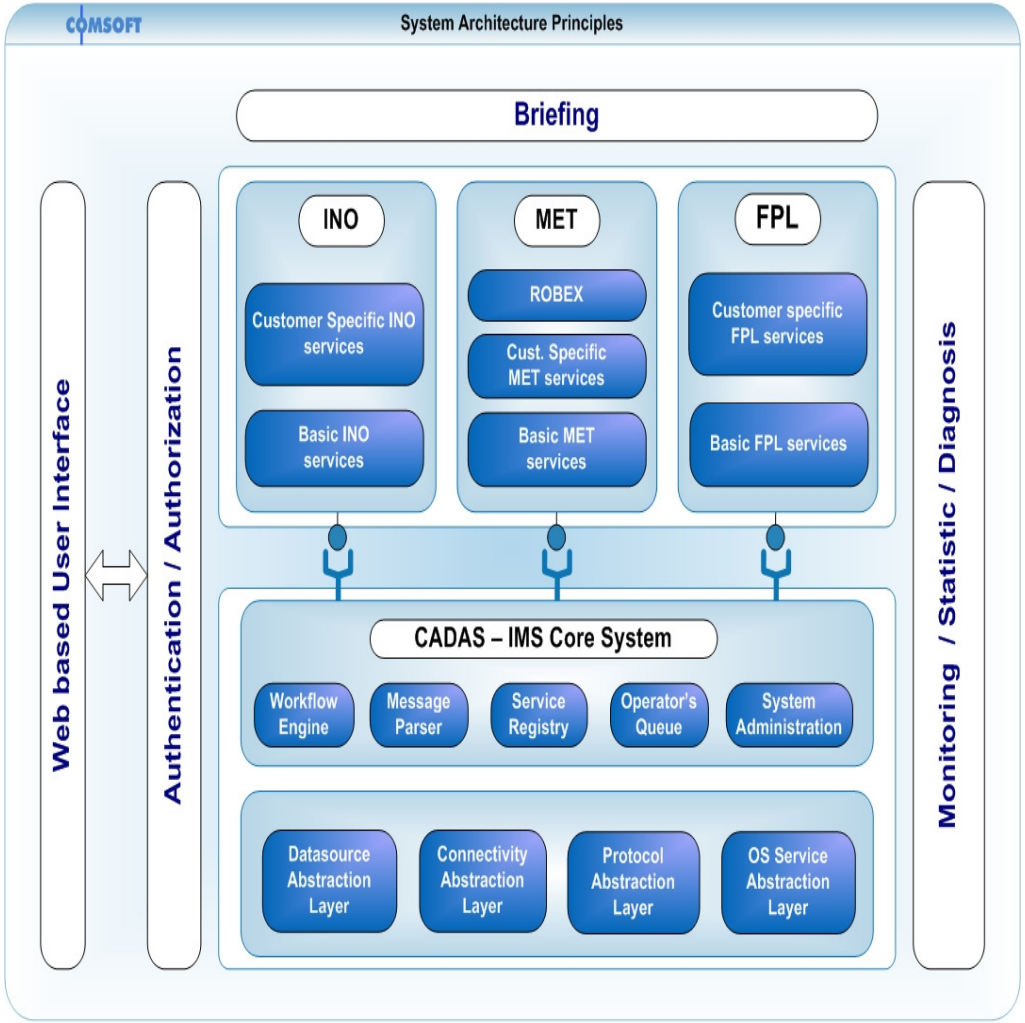
Flight Plan Management

- 46 standard compliant input forms are available for flight plan management.
- Further input forms get implemented on customer request
- Custom forms provide the same convenience with syntactic and semantic checking as known from standard forms



CADAS Information Management Systems

- Core System
  - Basic services
  - Infrastructure for Extendability and Interoperability
- Plugin Modules
  - INO
  - MET
  - SDO
  - Briefing
  - etc.
- Orthogonal Services
  - Security
  - Diagnosis
  - User Interface



eAIP

- Fully Automated. Database driven AIP production without user intervention possible.
- Support
  - AIP
  - AIP Amendments
  - AIP Supplements
  - AIP Circulars (AIC)
- EUROCONTROL SDP and ICAO Annex 15 compliant
- Based on latest version of AIXM.
- Web interface
- Parallel (concurrent) editing
- Version control
- Fully supports parallel amendments

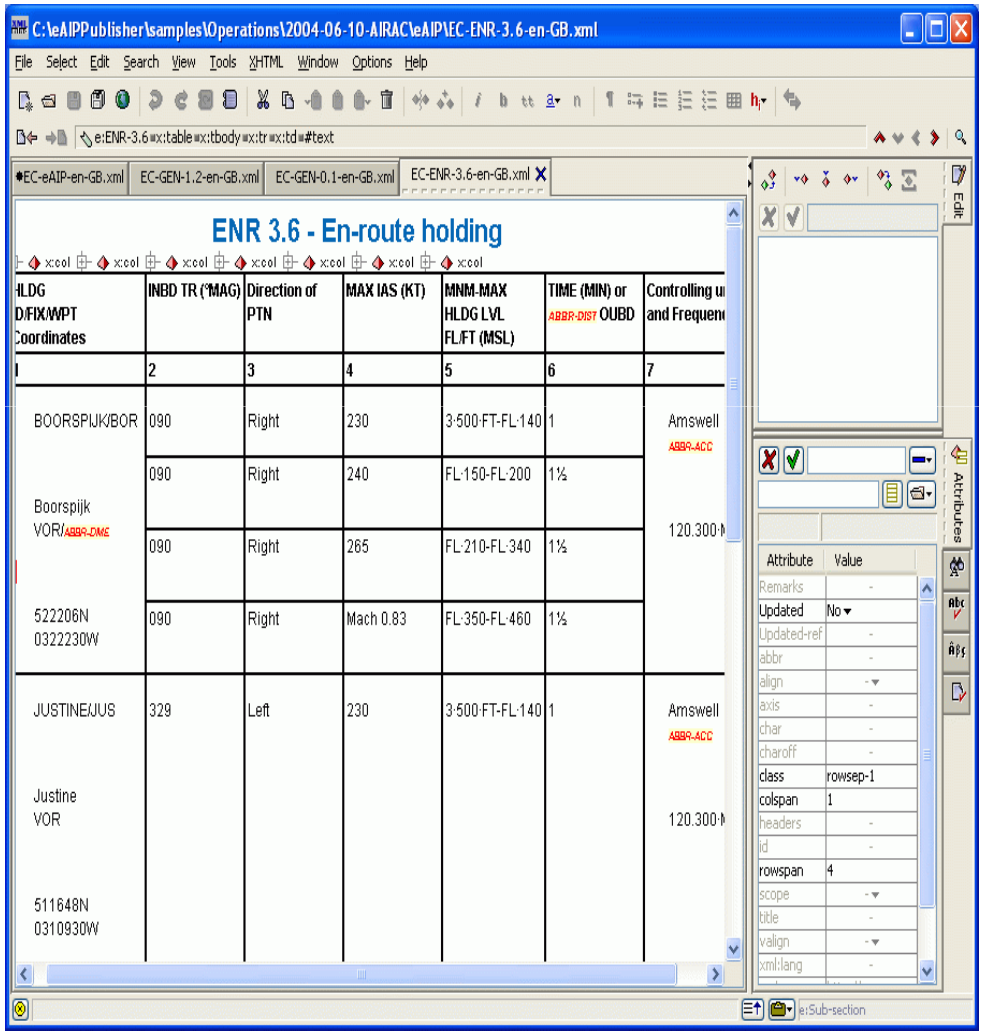
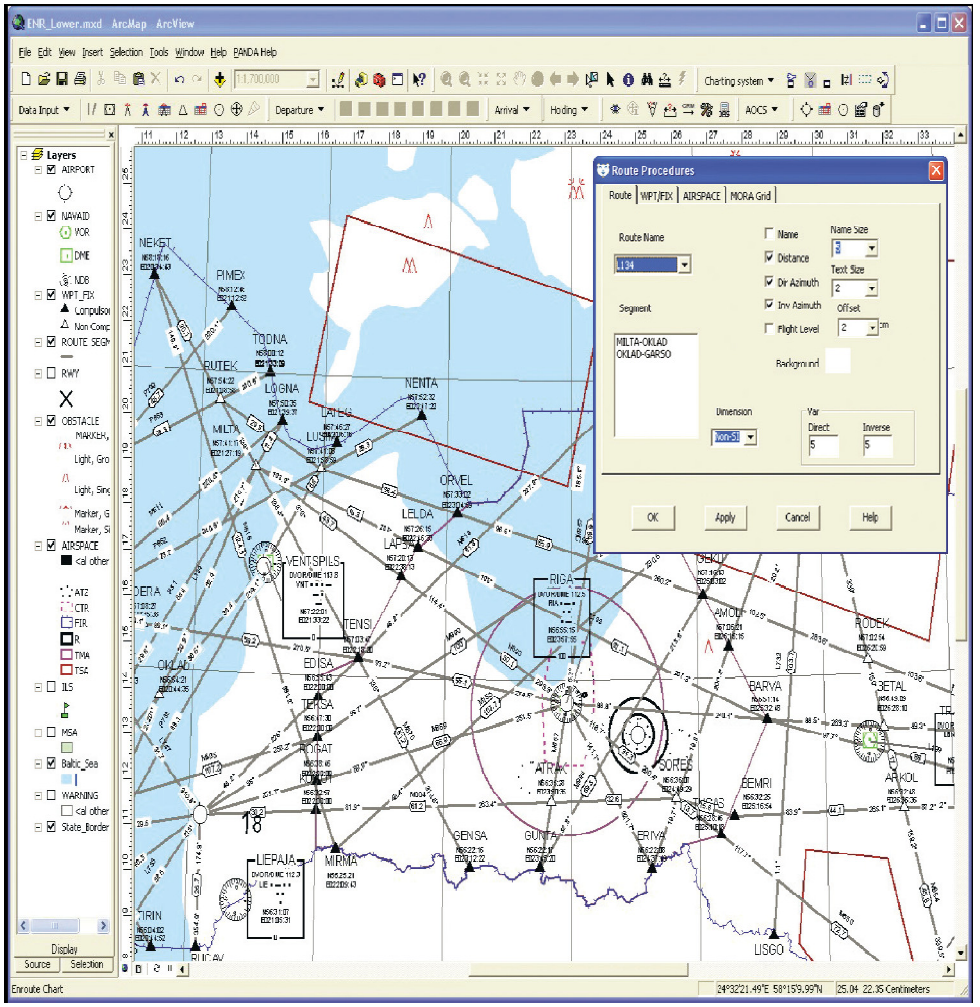


Chart Production

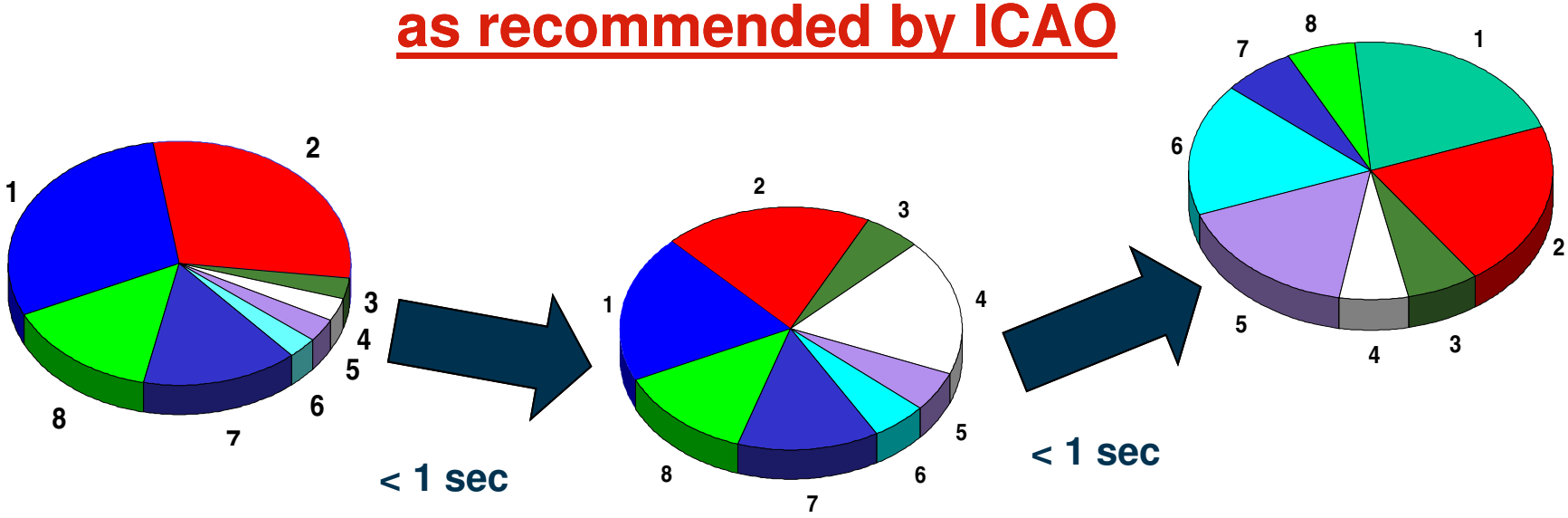
- Fully integrated software system
- Fully automated
- PANS-OPS master
- Extremely user friendly
- Quality assurance mechanisms
- Supports all standard ICAO defined chart types



// Example of Channel Capacity Allotment - *Sky*WAN MF-TDMA VSAT Network //

Bandwidth-on-Demand‘

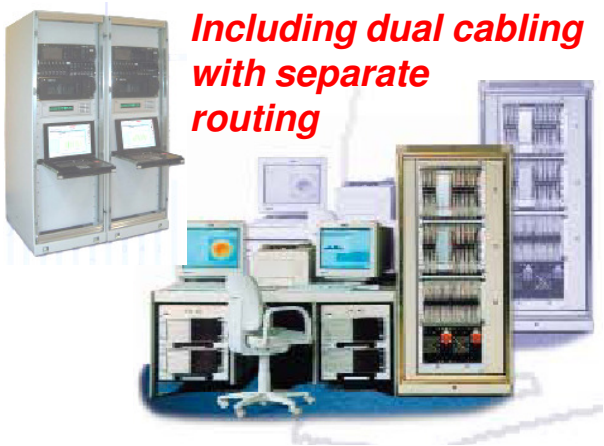
as recommended by ICAO



100% Standby applies not only for desert trips,
but much more for ATC Networks (Hot Redundancy / Parallel Operation Mode)

NO

‚SINGLE - POINT - OF - FAILURE‘



Including dual cabling with separate routing

Thank You!