



**INTERNATIONAL
CIVIL AVIATION
ORGANIZATION**



MCAAP INICIATIVES TO SUPPORT ANS

Innovative air traffic management and communication systems

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AGENDA

- ❑ Introduction to ADS-B, CPDLC, ADS-C, and AIDC
- ❑ CPDLC/ADS-C Initiative
- ❑ Technical Overview of ADS-B (Automatic Dependent Surveillance–Broadcast)
- ❑ GNSS Interference
- ❑ Monitoring Operation Network (MON)
- ❑ SBAS: SUPPORTING AVIATION
- ❑ National Air Navigation Plan: Strategic Vision
- ❑ Conclusions



CPDLC (CONTROLLER-PILOT DATA LINK COMMUNICATIONS) AND ADS-C FUNCTIONALITIES



Title:
Regional Implementation of CPDLC in the CAR Region

Objective:
Deploy **digital ATS communications (CPDLC)** to enhance safety and efficiency.

Problem:
Heavy reliance on voice communications
Increasing traffic and complexity
Lack of regional coordination strategy

Solution / Activities:
Regional workshop (ICAO NACC)
Technical missions (Oakland & Mexico)
SME and State participation
Development of CONOPS and roadmap

Expected Results:
Reduced communication errors
Improved controller workload management
Enhanced operational efficiency
Regional CPDLC implementation roadmap

Needed: PoC from Mexico, Curacao, Trinidad and Tobago, COCESNA and the FAA

PURPOSE AND SCOPE OF AIDC (ATS INTERFACILITY DATA COMMUNICATION)



Title:
Implementation of AIDC between Kingston FIR and Bogotá FIR

Objective:
Enable **automated ATS coordination** between CAR and SAM regions.

Problem:
Dependence on voice coordination
Increased workload and delays
Risk of coordination errors

Solution / Activities:
SME support for AIDC implementation
System configuration and interoperability
On-site validation (Jamaica)
Operational testing

Expected Results:
Automated flight data exchange (EST, ACP, TOC)
Reduced controller workload
Improved safety and efficiency
Foundation for regional AIDC expansion

Needed: PoC from Jamaica, COCESNA



TYPES AND SOURCES OF GNSS INTERFERENCE

Intentional Jamming

Deliberate transmission of signals to block or degrade GNSS signal reception, affecting navigation accuracy.

Unintentional Interference

Electronic devices can unintentionally emit signals that interfere with GNSS, reducing reliability of positioning.

Atmospheric Effects

Natural atmospheric conditions like ionospheric disturbances can degrade GNSS signal strength and accuracy.



IMPACT ON AIR NAVIGATION AND SAFETY

Surveillance Service Degradation

Interference reduces the effectiveness of air traffic surveillance systems, complicating flight monitoring and control.

Navigation Service Disruptions

Navigation systems can be disrupted by interference, raising risks for accurate flight path guidance.

Importance of Mitigation

Identifying and addressing interference is essential to preserve air navigation safety and reduce flight risks.



MONITORING OPERATION NETWORK (MON): DETECTION AND MITIGATION STRATEGIES

Title:
Development of MON for GNSS Resilience in CAR Region

Objective:
Ensure navigation continuity during GNSS outages through a Minimum Operational Network (MON).

Problem:
Increasing GNSS interference (jamming/spoofing)
High dependency on GNSS (PBN operations)
No regional contingency strategy

Solution / Activities:
SME development of MON framework
Regional infrastructure assessment
GNSS risk analysis
Integration with CAR/SAM initiatives

Expected Results:
Regional MON concept and roadmap
Improved CNS resilience
GNSS contingency capability
Alignment with ICAO Assembly A42 priorities

It is necessary that the initiative be support by all CAR States.

OPERATIONAL SCENARIOS AND EXPECTED OUTCOMES



CAR Region Frequency Management Validation Project

Objective:

Establish a **validated and harmonized regional frequency database** to ensure interference-free CNS operations.

Problem:

Inconsistent and outdated frequency data
Increasing interference (VHF COM/NAVAIDs)
Lack of regional baseline for Frequency Finder
Weak preparation for WRC-27

Solution / Activities:

3-week validation session at ICAO NACC
Participation of 2 CAR SMEs
Cross-check with AIPs and regional database
Support WRC-27 regional coordination

Expected Results:

Harmonized regional frequency registry
Reduced interference risks
Improved spectrum management
Strengthened CAR position for WRC-27

It is necessary that the initiative be support by all CAR States.



SBAS: SUPPORTING AVIATION

Satellite-Based Augmentation System (SBAS) enhances the Global navigation satellite system (GNSS) performance through corrections and integrity monitoring, enabling navigation capabilities consistent with ICAO SARPs.

In aviation, SBAS may support approach procedures with vertical guidance (e.g., LPV), improve positioning accuracy, and provide timely integrity alerts, contributing to operational safety and efficiency depending on implementation context.



SBAS is a system that makes global positioning system (GPS) provide accurate and reliable for airplanes. Overall, it improves safety, reduces delays, lowers costs, and makes flying more efficient and dependable.

WHAT IS SBAS?

SBAS augments GNSS signals with accuracy corrections, integrity monitoring, and fast alerts to enable safer and more precise navigation throughout all flight phases.



Accuracy



Integrity



Alerts

SBAS OPERATION

SUPPORTING ALL FLIGHT PHASES



SBAS GROUND SEGMENT



MONITORING STATIONS
Collect GNSS data



MASTER CONTROL STATION
Processes data and generates corrections and integrity information



UPLINK STATION
Sends data to the SBAS GEO satellite

SBAS IN ACTION

SBAS improves the navigation solution at every stage, providing:

- Higher accuracy
- Integrity monitoring
- Fast alerts
- Improved availability

1. TAKE-OFF

Accurate position and guidance for safe runway departure and initial climb.



Accuracy Integrity

2. CLIMB

Reliable navigation for efficient ascent and route tracking.



Accuracy Availability

3. CRUISE

Optimized route monitoring for fuel efficiency and airspace management.



Accuracy Continuity

4. DESCENT

Precise guidance for smooth descent and efficient path management.



Accuracy Integrity

5. APPROACH

Enables LPV approaches with vertical guidance, similar to ILS Cat I.



Precision Integrity

6. LANDING

Supports safe landings, even at airports without ground-based precision systems.



Safety Availability

THE SBAS ADVANTAGE THROUGHOUT THE JOURNEY



ENHANCED SAFETY
Integrity monitoring and fast alerts reduce risk.



GREATER EFFICIENCY
More direct routes and optimized operations.



WIDER ACCESS
Precision-like approaches at more airports.



ENVIRONMENTAL BENEFITS
Reduced fuel burn and lower emissions.



GLOBAL HARMONIZATION
Meets ICAO Standards and supports PBN.

From take-off to landing, SBAS delivers the accuracy, integrity, and reliability modern aviation needs.

AND AVIATION APPLICATIONS OF SBAS



SBAS provides real-time integrity monitoring, which is critical in aviation:

- SBAS provides real-time integrity monitoring, which is relevant for certain aviation application.

Potential:

- Detects GNSS signal anomalies (e.g., satellite faults, interference)
- Issues alerts within seconds (Time-to-Alert requirement)
- Ensures navigation data can be trusted for safety-critical operations

Operational impact:

- Supports precision-like approaches (LPV) without ground ILS
- May contribute to reduces risk of controlled flight into terrain (CFIT)
- May enhances situational awareness for pilots
- Precision Approach capability (LPV)
- Increase capability and efficiency duo support PBN (Performance-Based Navigation)
- SBAS reduces dependence on certain conventional navigation aids
- Improved access to remote aerodromes
- Support to navigation resilience (GNSS interference context)
- Environmental Benefits



SBAS CHALLENGES

KEY AREAS TO CONSIDER FOR SUCCESSFUL IMPLEMENTATION

TECHNICAL

- Ionospheric variability and modeling
- System performance and integrity requirements
- Complex ground infrastructure and data links
- Interference and spectrum protection
- System design and scalability



OPERATIONAL

- Limited aircraft equipage and avionics approval
- Procedure design and validation (LPV)
- Integration with ATM systems and operations
- Need for trained personnel and continuous monitoring
- Service continuity and maintenance



GOVERNANCE

- Clear institutional framework and responsibilities
- Sustainable service provision and oversight
- Coordination among States, ANSPs, and stakeholders
- Regulatory alignment with ICAO SARPs



FINANCIAL

- High initial investment and deployment costs
- Long-term operational and maintenance costs
- Uncertain cost recovery and business case
- Need for diversified and sustainable funding



REGIONAL AGREEMENTS

- Multinational coordination and alignment
- Data sharing and interoperability
- Harmonized policies and standards
- Equitable cost and benefit sharing
- Alignment with regional navigation plans



SBAS Satellite-Based Augmentation System



ACCURACY



INTEGRITY



AVAILABILITY

OTHERS

- Public and stakeholder awareness and support
- Technology evolution and future-proofing
- Environmental and space weather impacts
- Cybersecurity and data protection
- Long-term commitment and continuity



Addressing these challenges through collaboration, data-driven decisions, and long-term commitment is essential to realize the full potential of SBAS for safe, efficient, and resilient aviation.



NATIONAL AIR NAVIGATION PLAN: STRATEGIC VISION



OBJECTIVES OF THE NATIONAL AIR NAVIGATION PLAN

Enhancing Safety

Improving air navigation safety by adopting advanced technologies and standardized procedures nationwide.

Increasing Capacity

Expanding airspace capacity to manage more flights efficiently through harmonized navigation procedures.

Environmental Performance

Reducing environmental impact by optimizing flight paths and using greener navigation technologies.

ALIGNMENT WITH ICAO GLOBAL AIR NAVIGATION PLAN



ICAO Strategic Alignment

The plan supports ICAO's strategic goals to maintain global aviation standards and safety.

International Compliance

Ensures that air navigation systems comply with international regulations and agreements.

Interoperability in Air Traffic

Promotes seamless communication and coordination across international air traffic management systems.

Contribution to Global ATM

Enhances the efficiency and safety of the global air traffic management network.

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Thank You!