FAA/SSA/ICAO Workshop on Performance-based communication and surveillance (PBCS) Dakar, 11-15 September 2017

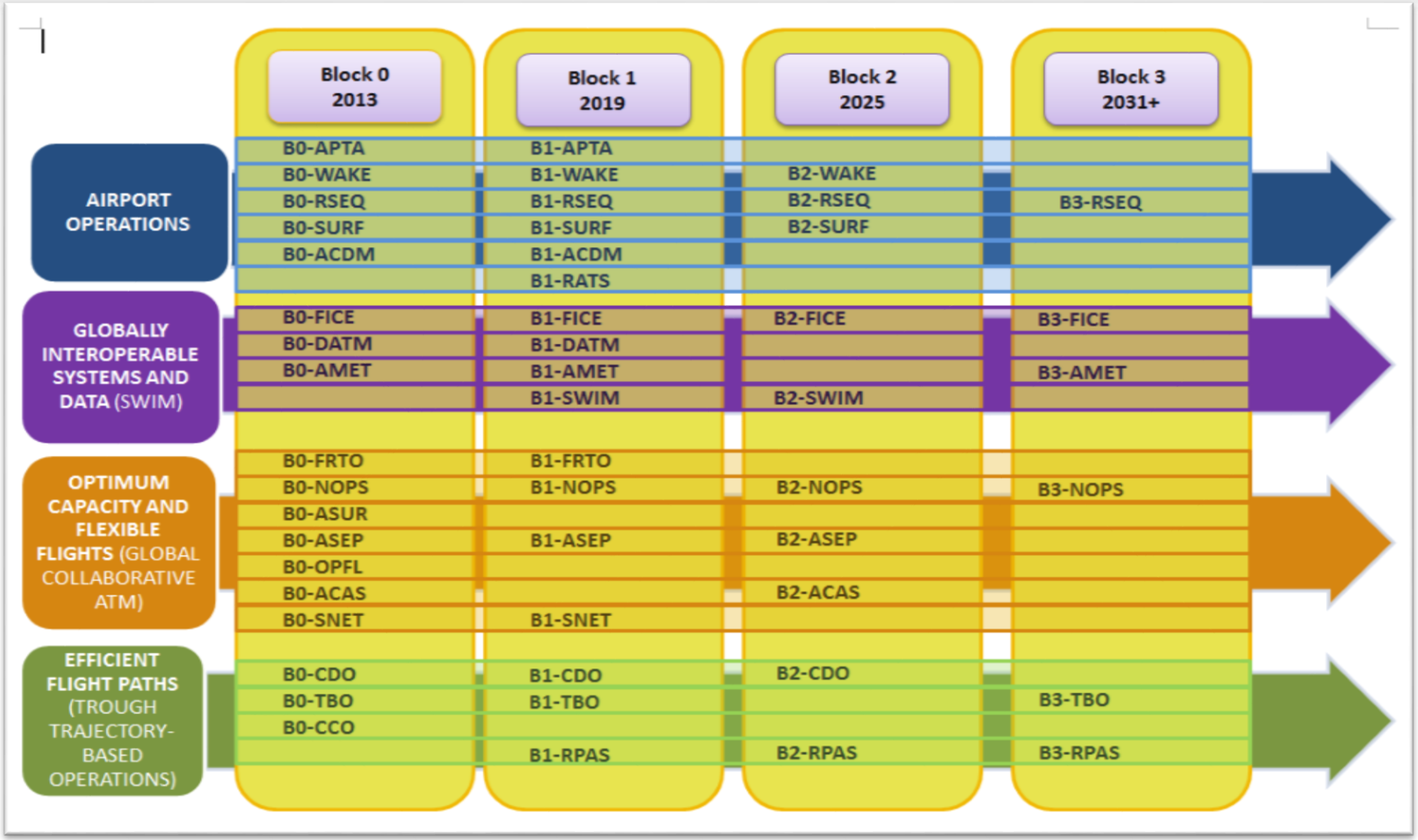
ICAO Provisions on Data Link Implementation

Prosper Zo'o Minto'o
ICAO DRD, Dakar

Outline

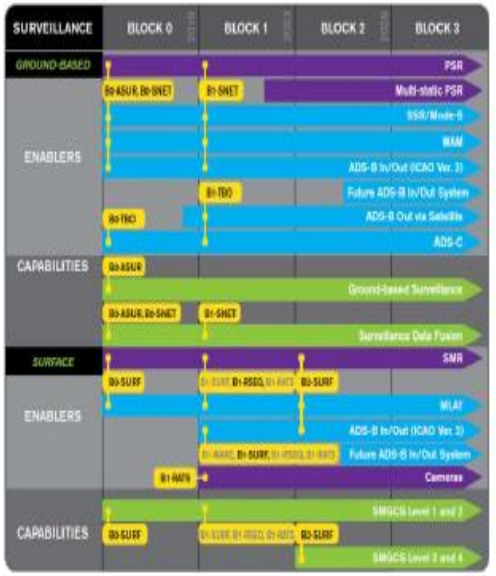
- GANP and ASBUs
- ICAO SARPs, PANS and Manuals
- Performance-Based Separation
- APIRG Conclusions related to ATS Data Link
- Summary & Conclusions

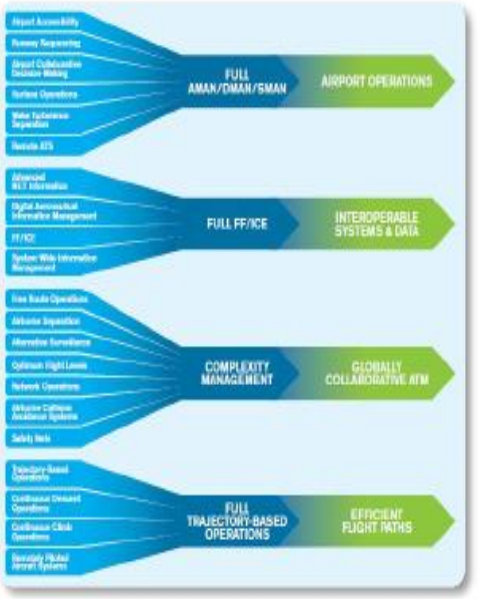
GANP – A Global Roadmap


Block 0 2013
Block 1 2019
Block 2 2025
Block 3 2031+
AIRPORT OPERATIONS
B0-APTA
B0-WAKE
B0-RSEQ
B0-SURF
B0-ACDM
B1-APTA
B1-WAKE
B1-RSEQ
B1-SURF
B1-ACDM
B1-RATS
B2-WAKE
B2-RSEQ
B2-SURF
B3-RSEQ
GLOBALLY INTEROPERABLE SYSTEMS AND DATA (SWIM)
B0-FICE
B0-DATM
B0-AMET
B1-FICE
B1-DATM
B1-AMET
B1-SWIM
B2-FICE
B2-SWIM
B3-FICE
B3-AMET
OPTIMUM CAPACITY AND FLEXIBLE FLIGHTS (GLOBAL COLLABORATIVE ATM)
B0-FRTO
B0-NOPS
B0-ASUR
B0-ASEP
B0-OPFL
B0-ACAS
B0-SNET
B1-FRTO
B1-NOPS
B1-ASEP
B1-SNET
B2-NOPS
B2-ASEP
B2-ACAS
B3-NOPS
EFFICIENT FLIGHT PATHS (TROUGH TRAJECTORY-BASED OPERATIONS)
B0-CDO
B0-TBO
B0-CCO
B1-CDO
B1-TBO
B1-RPAS
B2-CDO
B2-RPAS
B3-TBO
B3-RPAS

GANP – A Global Roadmap

- The Global Air Navigation Plan
- The Roadmaps

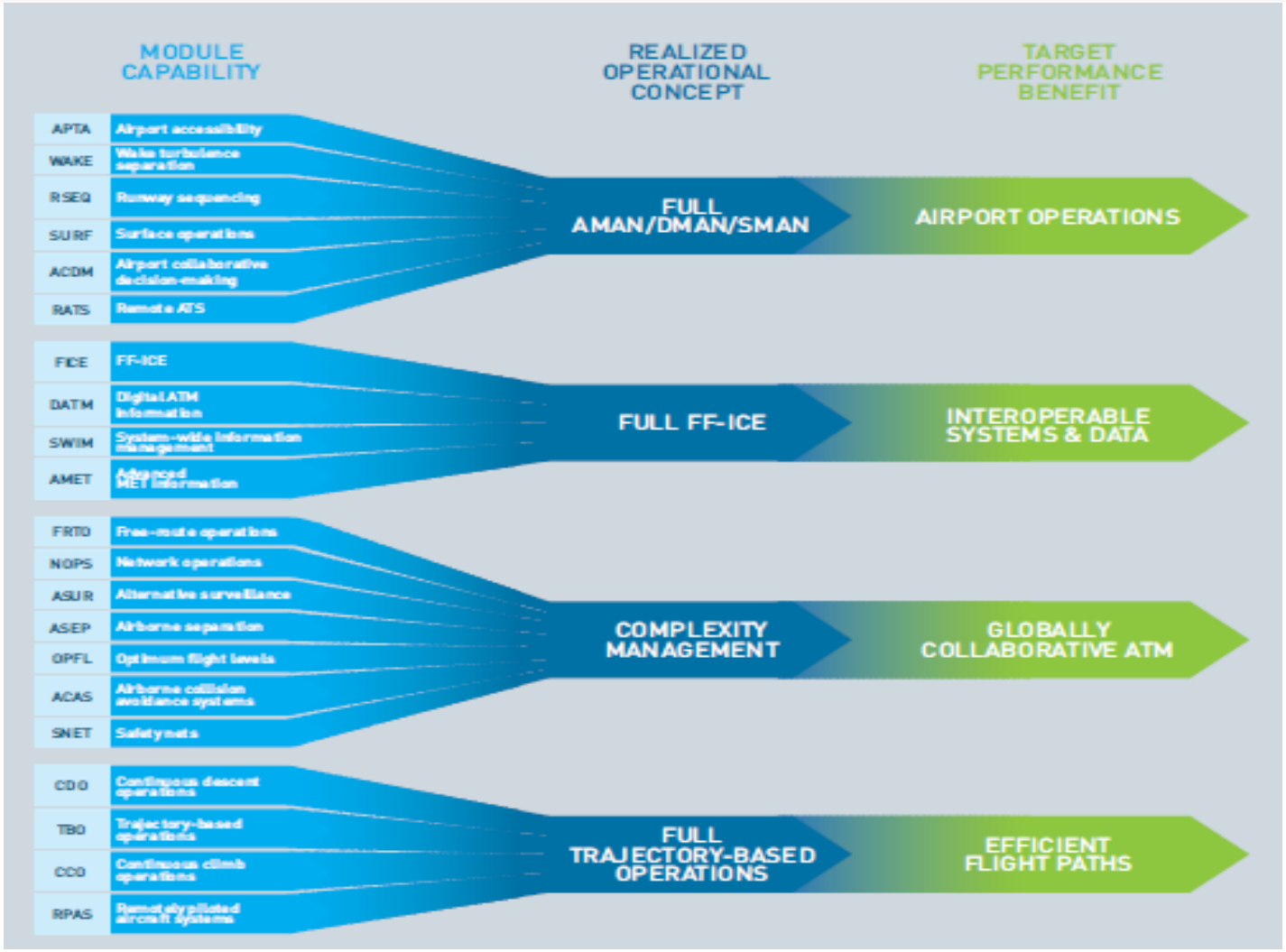




ICAO's 10 Key Air Navigation Policy Principles

06 Regional and State Air Navigation Priorities

- ICAO regions, sub-regions and individual States through the PIRGs should **establish their own Air Navigation priorities** to meet their individual needs and circumstances in line with the Global Air Navigation Priorities


MODULE CAPABILITY
REALIZED OPERATIONAL CONCEPT
TARGET PERFORMANCE BENEFIT
APTA
Airport accessibility
WAKE
Wake turbulence separation
RSEQ
Runway sequencing
SURF
Surface operations
ACDM
Airport collaborative decision-making
RATS
Remote ATS
FULL AMAN/DMAN/SMAN
AIRPORT OPERATIONS
FICE
FF-ICE
DATM
Digital ATM Information
SWIM
System-wide Information management
AMET
Advanced MET information
FULL FF-ICE
INTEROPERABLE SYSTEMS & DATA
FRTO
Free-route operations
NOPS
Network operations
ASUR
Alternative surveillance
ASEP
Airborne separation
OPFL
Optimum flight levels
ACAS
Airborne collision avoidance systems
SNET
Safetynets
COMPLEXITY MANAGEMENT
GLOBALLY COLLABORATIVE ATM
CDO
Continuous descent operations
TBO
Trajectory-based operations
CCO
Continuous climb operations
RPAS
Remotely piloted aircraft systems
FULL TRAJECTORY-BASED OPERATIONS
EFFICIENT FLIGHT PATHS

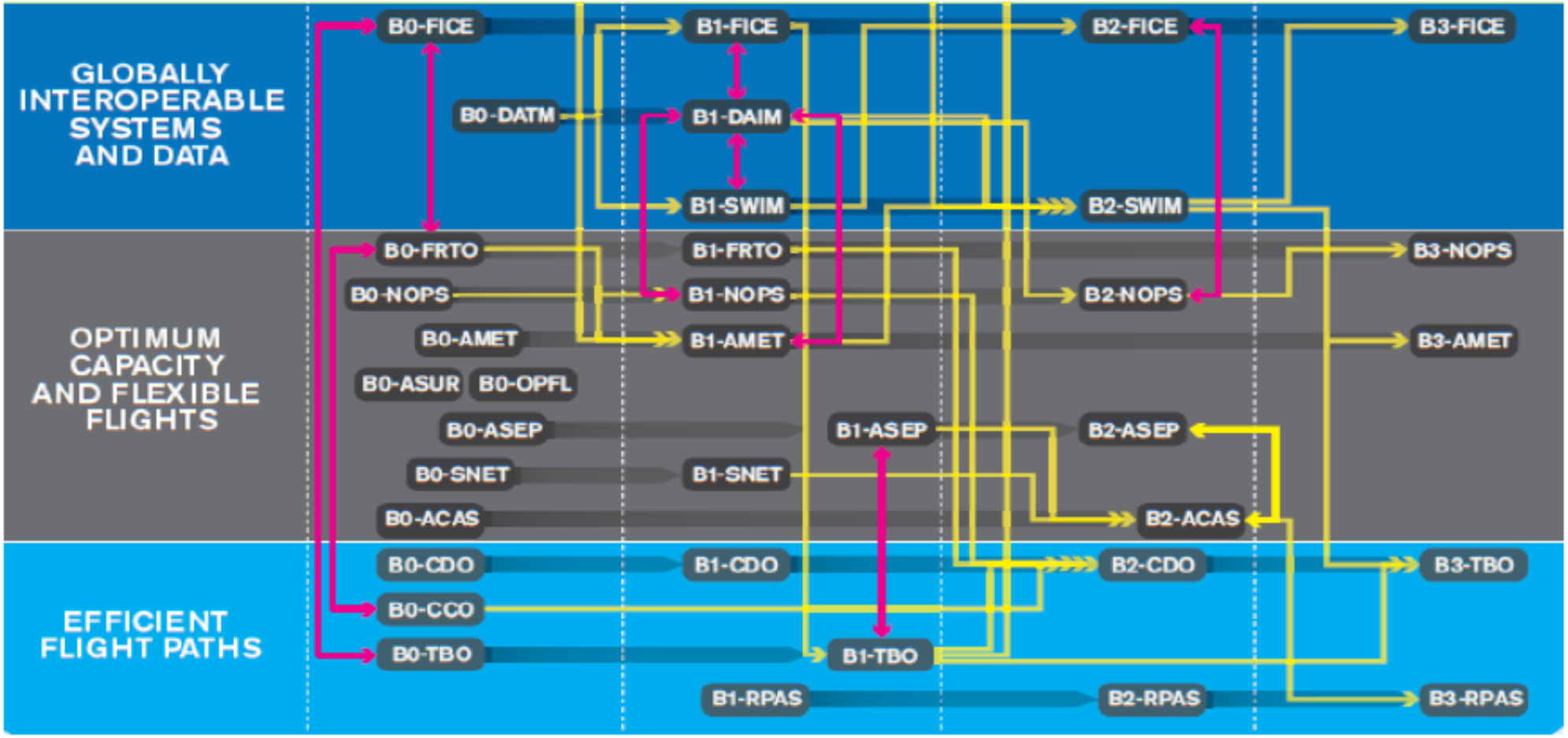
Performance Improvement Area 2:
Globally interoperable systems and data – through globally interoperable system-wide information management

Block 0	Block 1	Block 2	Block 3
B0-FICE **Increased interoperability, efficiency and capacity through ground-ground integration** Supports the coordination of ground-ground data communication between ATSUs, based on ATS interfacility data communication (AIDC) defined by ICAO Document 9694.	**B1-FICE** **Increased interoperability, efficiency and capacity through FF-ICE, Step 1 application before departure** Introduction of FF-ICE step 1, to implement ground-ground exchanges before departure using common flight information reference model, FIXM, XML and the flight object.	**B2-FICE** **Improved coordination through multi-centre ground-ground integration (FF-ICE, Step 1 and flight object, SWIM) including execution phase** FF-ICE supporting trajectory-based operations through exchange and distribution of information including execution phase for multicentre operations using flight object implementation and interoperability (IOP) standards.	**B3-FICE** **Improved operational performance through the introduction of Full FF-ICE** Data for all relevant flights is systematically shared between air and ground systems using SWIM in support of collaborative ATM and trajectory-based operations.
B0-DATM **Service improvement through digital aeronautical information management** Initial introduction of digital processing and management of information, by the implementation of AIS/AIM making use of AIXM, moving to electronic AIP and better quality and availability of data.	**B1-DATM** **Service improvement through integration of all digital ATM information** This module addresses the need for increased information integration and will support a new concept of ATM information exchange fostering access via internet-protocol-based tools Exchange models such as AIXM, FIXM, IWXXM and others relate their concepts to the AIRM fostering convergence, re-use, and collaborative alignment.	**B2-SWIM** **Enabling airborne participation in collaborative ATM through SWIM** Connection of the aircraft as an information node in SWIM enabling participation in collaborative ATM processes with exchange of data including meteorology.	
	B1-SWIM **Performance improvement through the application of system-wide information management (SWIM)** Implementation of SWIM services (applications and infrastructure) creating the aviation intranet based on standard data models, and internet-based protocols to maximize interoperability.		

Performance Improvement Area 4:
Efficient flight path – through trajectory-based operations

Block 0	Block 1	Block 2	Block 3
B0-TBO **Improved safety and efficiency through the initial application of data link and SATVOICE en-route** Implementation of an initial set of data link applications supporting surveillance and communications in air traffic services.	B1-TBO **Improved traffic synchronization and initial trajectory-based operation** To improve the synchronization of traffic flows at en-route merging points and to optimize the approach sequence through the use of 4DTRAD capability and airport applications, e.g. D-TAXI, via the air ground exchange of aircraft derived data related to a single required time of arrival (RTA).		B3-TBO **Full 4D trajectory-based operations** Trajectory-based operations deploys an accurate four-dimensional trajectory that is shared among all of the aviation system users at the cores of the system. This provides consistent and up-to-date information system-wide which is integrated into decision support tools facilitating global ATM decision-making.

Dependencies of TBO modules



Why Data Link ?

- **Enhanced conformance monitoring capability** in the airspace over remote and oceanic areas
- clear messages with **less risk of misunderstandings**
- additional, independent and secure channel, which **reduces the strain on busy sector frequencies**
- **Increased capacity and the day-to-day efficiency** of communications between controllers and pilots

Why Data Link ?

- Air traffic is predicted to **double** in the next 15 years
- Our collective responsibility is to **allow the aviation system** to safely realize this growth
- **Use of data link may not be optional** anymore to increase efficiency and optimize the use of available airspace

Why Data Link ?

- Air traffic is predicted to **double** in the next 15 years
- Our collective responsibility is to **allow the aviation system** to safely realize this growth
- **Use of data link may not be optional** anymore to increase efficiency and optimize the use of available airspace

Why Data Link ?

- When you apply **separation standards that rely on data link capability and performance**
  - 30 NM and 50 NM longitudinal separation,
  - RLatSM – 23 NM lateral separation,
  - RLongSM – 5 Minutes longitudinal separation
- If you **lose the data link connection**, you **may have lost separation**

- ✓ *Is data link connection always satisfactory ?*
- ✓ *Do all data link systems have same performance ?*
- ✓ *Are all personnel involved well-trained ?*

The answer is……????

Annexes, PANS and Manuals

Related to Data Link Implementation

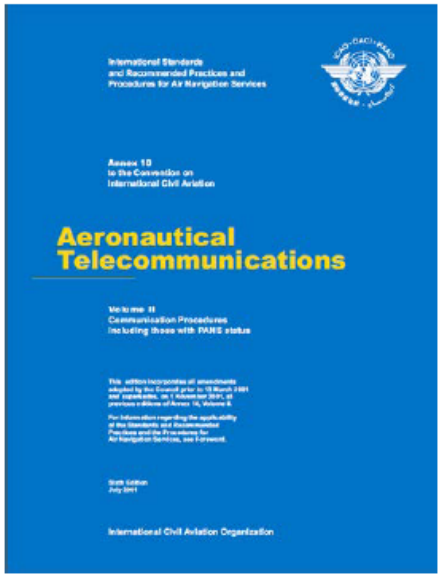
Two Aspects to Data Link

- The "Service and Message"
  - *"Content" and "Procedures"*
  - *Handled by OPLINKP (Now OPDLWG)*

- The "*Medium*"
  - *Various media and the network supporting them*
  - *Handled by ACP (Now DCIWG)*

For Services and Messages ….

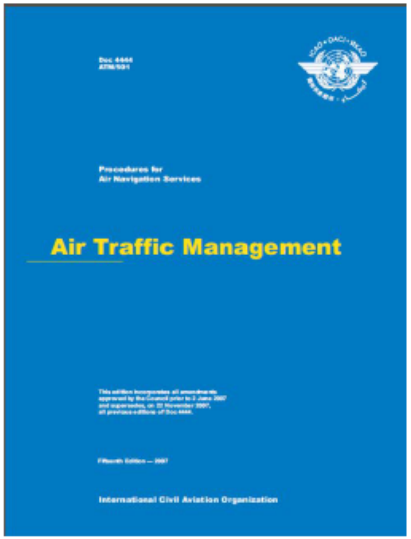
- **Annex 10 Volume II is the key "standard"**
  - Composition of data link messages
  - Display of data link messages
  - CPDLC procedures
- **Supported by PANS-ATM and Manuals**



PANS-ATM (Doc 4444)

Chapter 4 General Provisions for Air Traffic Services

- 4.11 Position Reporting
  - 4.11.4 Transmission of ADS-C reports
  - 4.11.5 Contents of ADS-C reports
- 4.15 Data Link Communications initiation Procedures

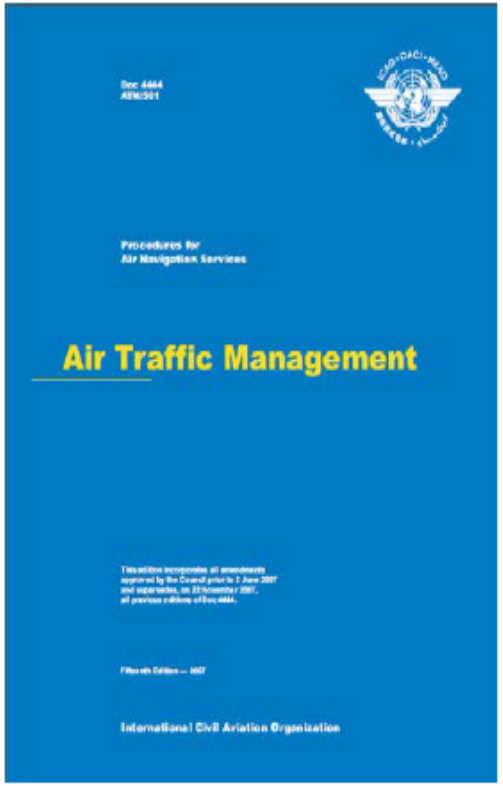


PANS-ATM (Doc 4444)

Chapter 5 Separation methods and minima

Chapter 13 ADS-C Services

- ADS-C Ground system capabilities
- ADS-C related aeronautical information
- Use of ADS-C in the provision of ATC service
- Use of ADS-C in the application of separation minima



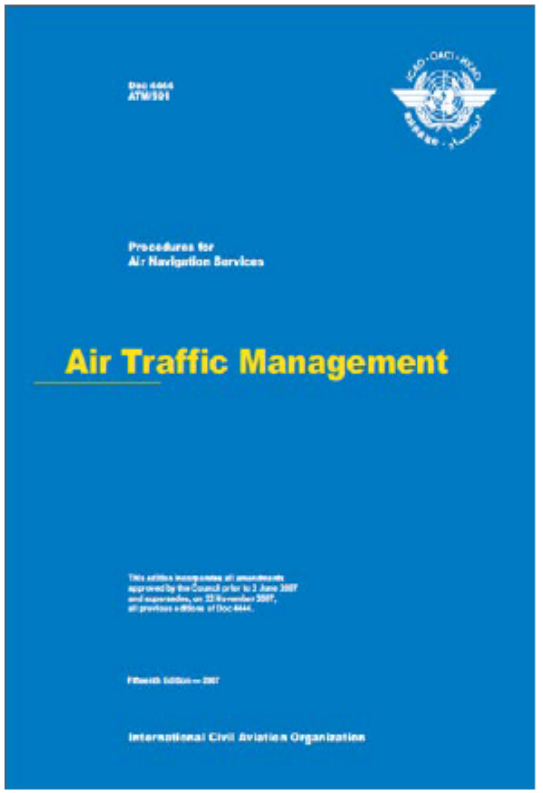
PANS-ATM (Doc 4444)

Chapter 14 CPDLC

- Establishment of CPDLC
- Exchange of operational CPDLC messages

Appendix 2 Flight Plan, Item 10

Appendix 5 CPDLC Message Set



Global Operational Data Link (GOLD) Manual

- Annex 10 Volume III is the key "standards" document.
- Supported by a number of ICAO Manuals

ICAO Manuals on Data Link Media (1)

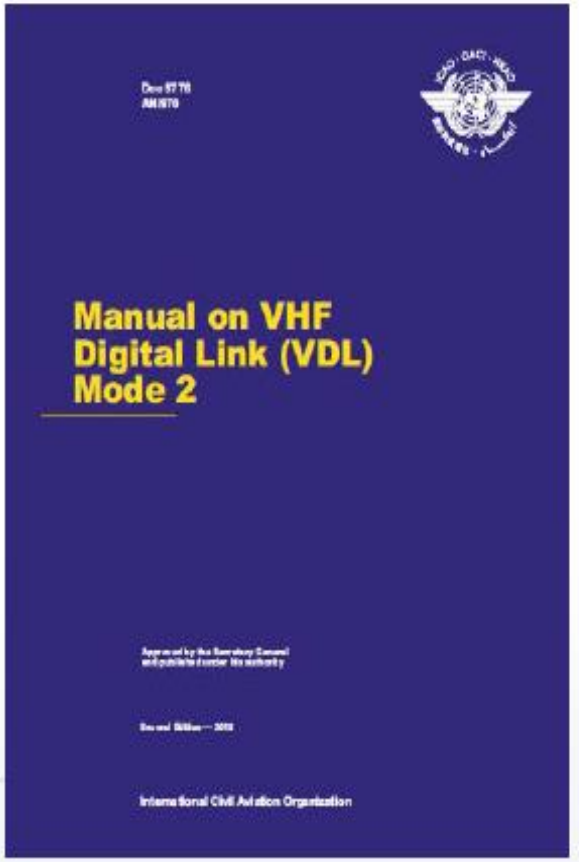
- **For the ATN,** there are two key documents
  - **Doc 9880:** *Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols*
  - **Doc 9896:** *on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocols*

ICAO Manuals on Data Link Media (2)

- **For individual media:**
  - **Doc 9776:** *Manual on VHF Digital Link (VDL) Mode 2*
  - **Doc 9925:** *Manual on Aeronautical Mobile (Route) Service*
  - **Doc 10044:** *Manual on Aeronautical Mobile Airport Communications System (AeroMACS) (to be published in 2016)*

Doc 9776

- **2nd Edition in 2015**
  - Has multi-frequency support for NextGen/SESAR
  - Solves congestion-based problems to date.
- **Is OSI-based and is part of LINK2000.**



PBCS Framework

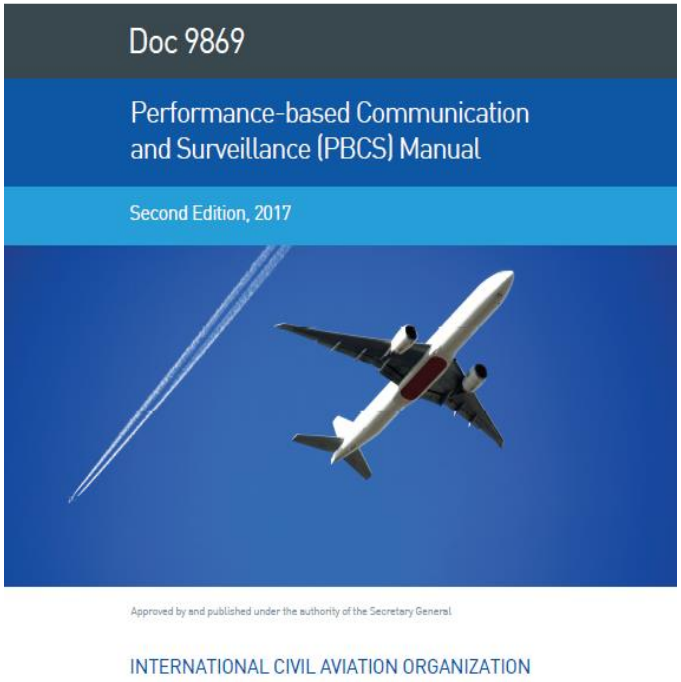
PBN

- *Prescription of RCP and RSP* for air traffic services that are predicated on communication and surveillance performance ***(Annex11)***;
- *Approval of aircraft and operators* for a communication and/or surveillance capability including aircraft equipage for operations where RCP and/or RSP specifications have been prescribed ***(Annex 6)***;
- *indication of an aircraft's communication and surveillance capability and performance* in the form of RCP/RSP specifications in the flight plan ***(PANS-ATM)***;
- *monitoring programmes to assess actual communication and surveillance performance* against RCP and RSP specifications ***(Annexes 6 and 11)***
- *corrective actions,* as applicable, for the appropriate entity ***(Annexes 6 and 11)***.

RVSM

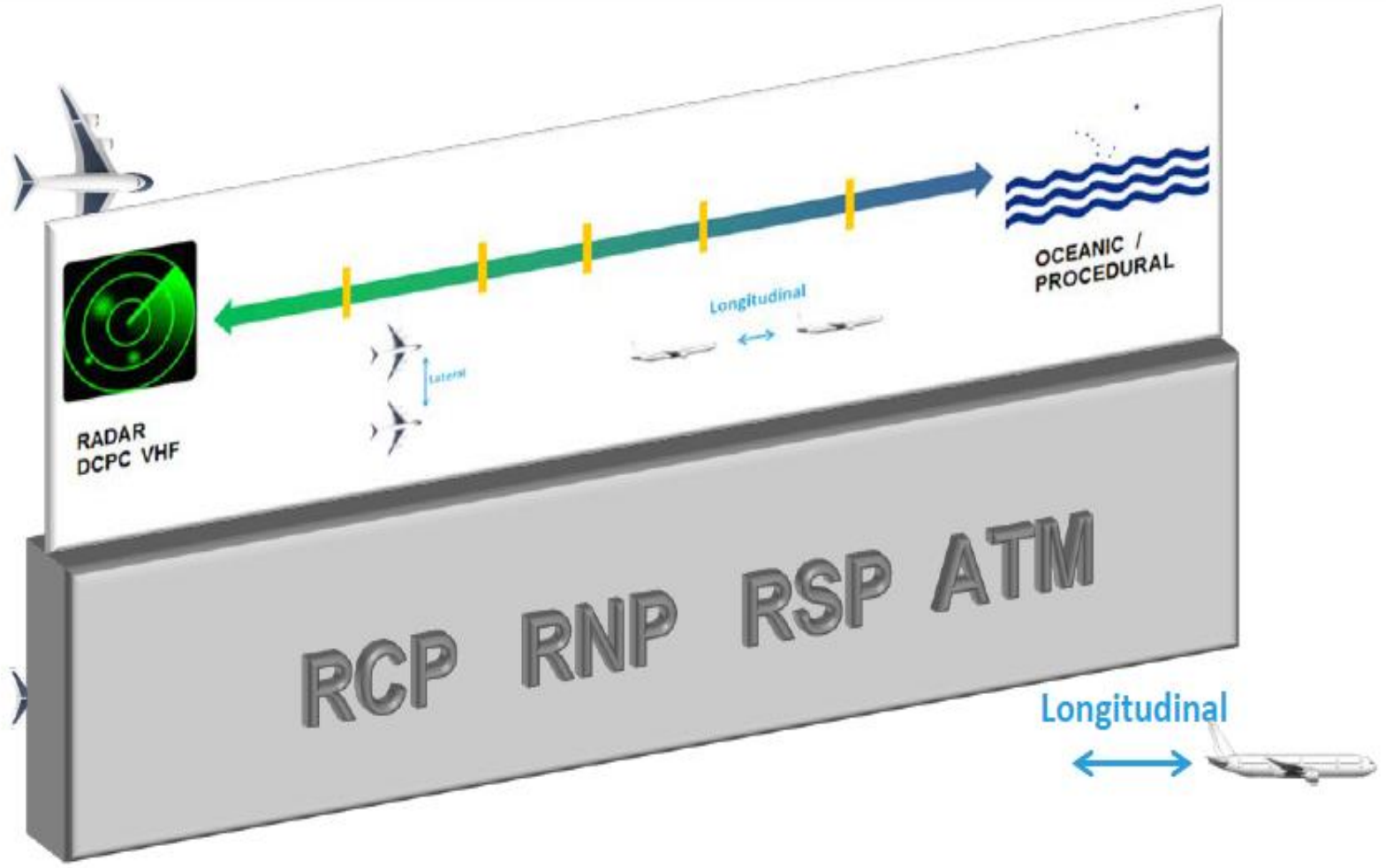
Performance-based Communication and Surveillance Manual (Doc 9869)

- Developed based on the RCP Manual (Doc 9869), GOLD, SVGM and other regional material
- Expanded the scope to include:
  - PBCS concept and surveillance capability
  - RCP and RSP specifications;
  - information and guidance provided from several workshops held in the regions; and
  - material from PIRG meetings and their contributory groups



Performance-based Separation

Filling in the Gaps between Radar and Procedural Separations


RADAR
DCPC VHF
Lateral
Longitudinal
OCEANIC /
PROCEDURAL
RCP RNP RSP ATM
Longitudinal

Not less than 30 NM (55.5 Km)

Lateral Separation

- **NAVIGATION : *RNP 4 or RNP 2***
- **COMMUNICATION : *RCP 240***
- **SURVEILLANCE : *RCP 180***
- lateral deviation change event with a maximum of 5 NM threshold and a waypoint change event

Longitudinal Separation

Not less than 10 Minutes

- **NAVIGATION :** ***RNP 10, RNP 4 or RNP 2***
- **COMMUNICATION :** ***RCP 240***
- **SURVEILLANCE :** ***RSP 180***
- Cruising, climbing or descending on the same or crossing track

APIRG

Conclusion 20/09: Implementation of ICAO PBCS Manual (DOC 9869) and GOLD Manual (DOC 10037)

That:

- **a) States, Air Navigation Service Providers (ANSPs) and users take necessary action to apply the technical and operational guidance provided in the Second Edition of Doc 9869 (Performance Based Communication and Surveillance (PBCS) Manual) and the Global Operational Datalink (GOLD) Manual (Doc 10037) once published;**
- **b) States and ANSPs that have already implemented CPLDC/ADS-C review their systems performance using PBCS Manual and take immediate action where remedial measures are necessary; and**
- **c) ICAO should provide assistance to States facing implementation challenges under the No Country Left Behind (NCLB) initiative to ensure that communication and surveillance requirements are met by all AFI States.**

APIRG

Conclusion 20/24: Establishment of a Project Team for the implementation of a data link central monitoring and reporting agency (DL/CMRA)

That:

- **a) A Project Team comprised of Cabo Verde (as Team Leader), Ghana, ASECNA, South Africa, Seychelles, AFRAA and IATA be established to identify and propose the main functions of an AFI DL/CMRA, the appropriate organizational framework and a suitable cost effective funding mechanism; and**

- **b) The Project Team Leader should provide a report of the activities of the project, which are to be mainly done through electronic conferences to the Secretariat for submission to the APCC and the outcome should subsequently be submitted to APIRG/21.**

Summary & Conclusions

- ATS Data Link is a fundamental enabler for realizing the concept of future operations (FF-ICE, TBO and SWIM)
- However, further work is needed to ensure seamless and safe implementation of ATS Data Link
- There are a number of ICAO Annexes, PANS and Manual concerning ATS Data Link (Service/Message and Media) and they are evolving.
- There is an increasing need of application of performance-based ATM operations predicated on data link capabilities and performance

ICAO


North American Central American and Caribbean (NACC) Office Mexico City
South American (SAM) Office Lima
ICAO Headquarters Montréal
Western and Central African (WACAF) Office Dakar
European and North Atlantic (EUR/NAT) Office Paris
Middle East (MID) Office Cairo
Eastern and Southern African (ESAF) Office Nairobi
Asia and Pacific (APAC) Sub-office Beijing
Asia and Pacific (APAC) Office Bangkok
THANK YOU