Session 2: Introduction to Data Link

CPDLC / ADS-C benefits / overview

Presented to: Operational Data Link Familiarization Seminar (Nairobi, Kenya)

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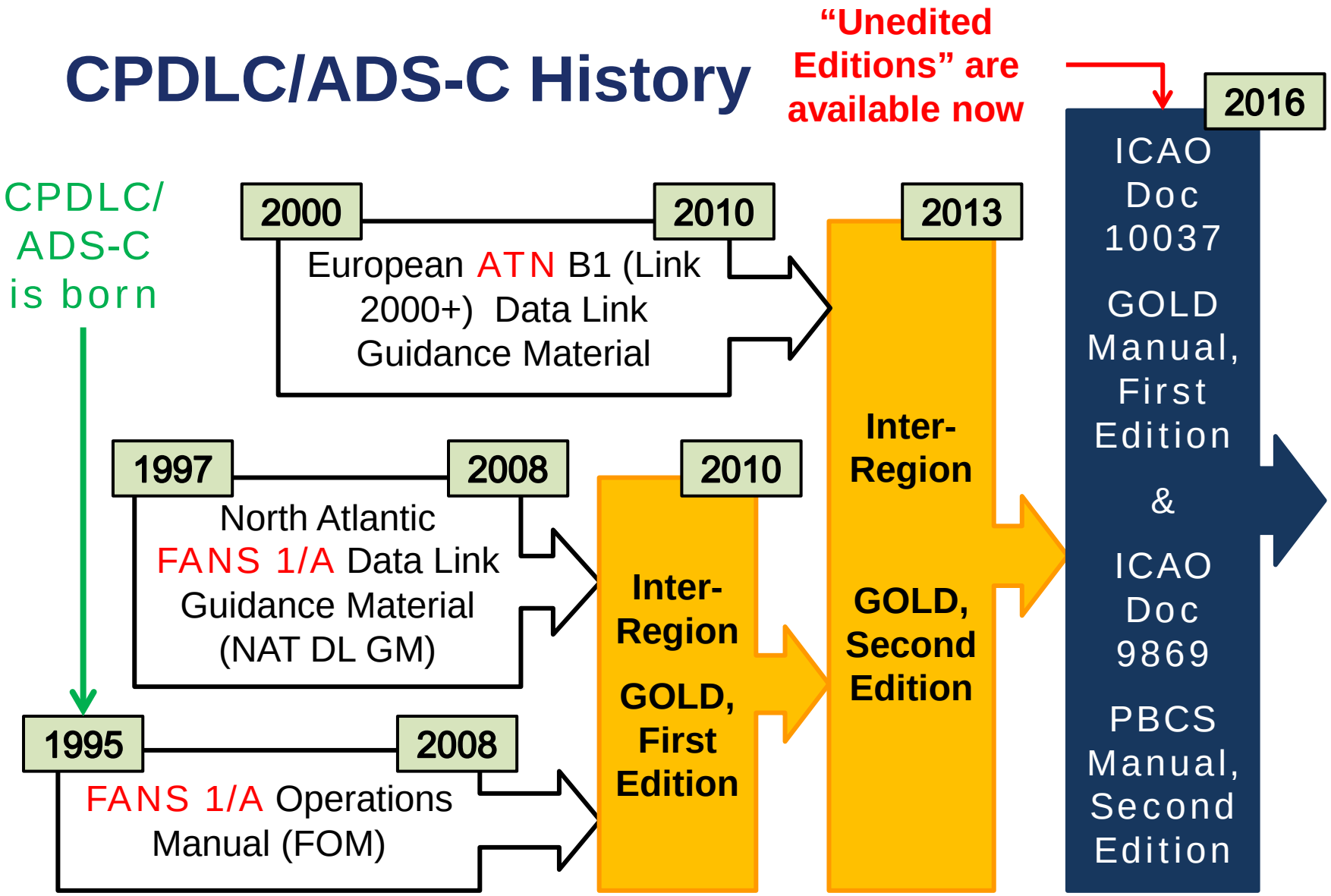
Federal Aviation Administration

CPDLC/ADS-C History

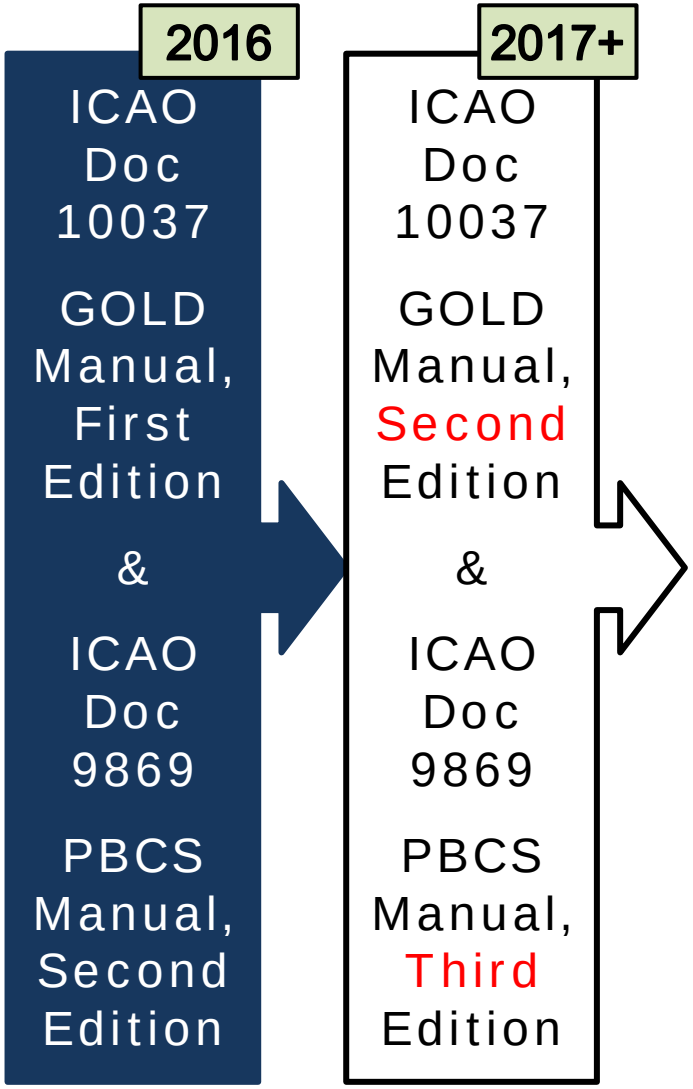


Global harmonization is key to success

- **CPDLC and ADS-C benefits have been proven (see later slides)**
- **Biggest hindrance to CPDLC and ADS-C progress → different implementations**
- **“GOLD is a very significant step towards the global harmonization of ADS-C and CPDLC procedures for pilots and air traffic controllers” – Mokhtar A. Awan, Regional Director of ICAO Asia and Pacific Office**

CPDLC/ADS-C Future

- **Revise ICAO GOLD (Doc 10037) Manual and PBCS Manual (Doc 9869)**
- **Will include "planning" guidance for next generation data link implementation, based on Industry's "Baseline 2" Data Link Standards (RTCA/EUROCAE)**

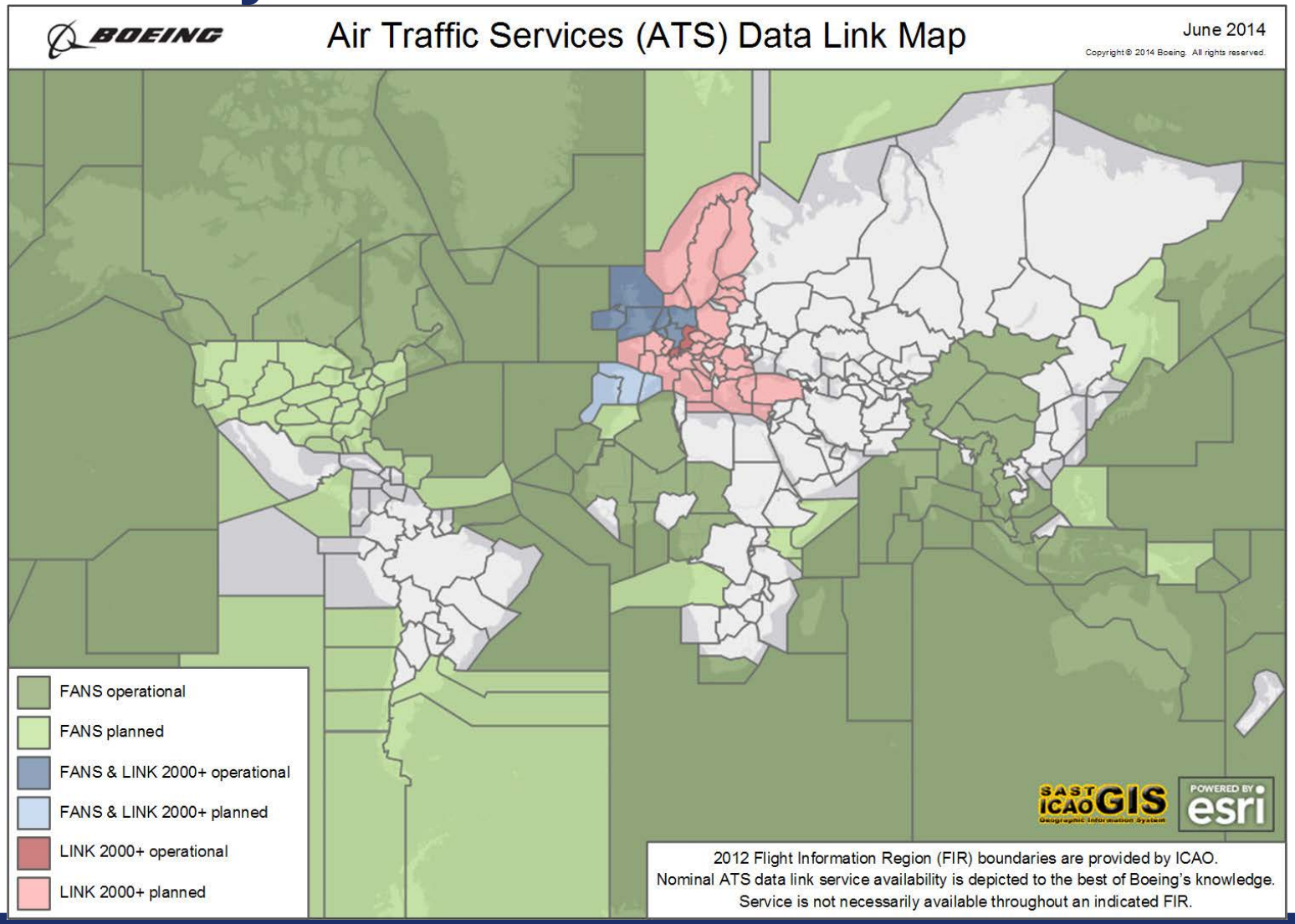


ICAO Annex and PANS Provisions

- **GOLD and PBCS Manuals – support ICAO Annexes and PANS**
- **Annex – State must comply or file deviation with ICAO**
- **PANS – State must comply or publish difference in AIP**

Document	Title of Document
Annex 6	Operation of Aircraft
Annex 10	Aeronautical Telecommunications
Annex 11	Air Traffic Services
Annex 15	Aeronautical Information Services
Annex 19	Safety Management
Doc 4444	Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM)
Doc 8400	Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS–ABC)

It is really about IMPLEMENTATION



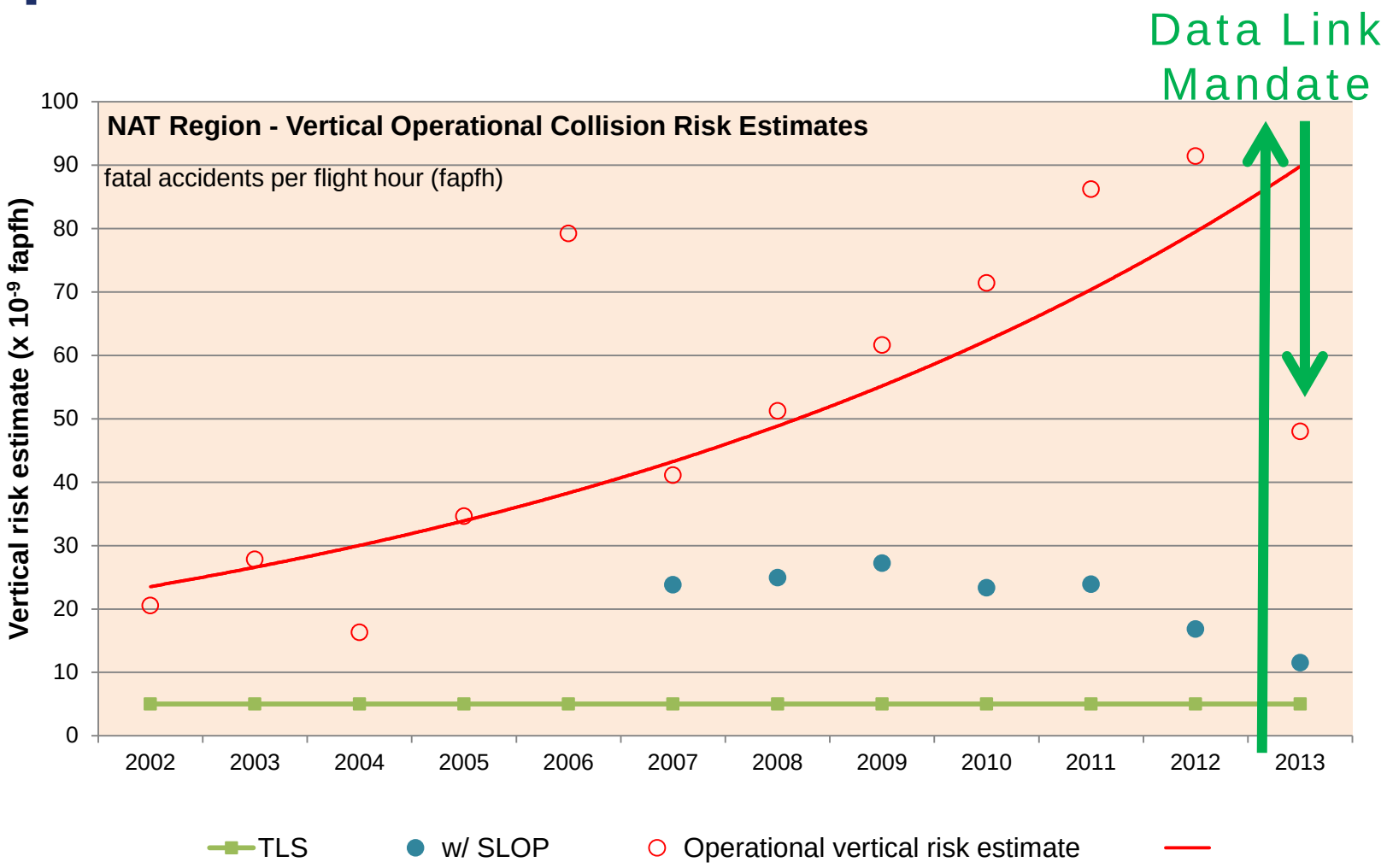
… and BENEFITS

- **Enables safer and more efficient ATM**
- **Improves communications and controller intervention capability**
- **Improves surveillance and flight conformance monitoring (reduce number and duration of incidents)**
- **Allows the flight crew to print, store and review messages**
- **Allows the flight crew to load information from specific uplink messages, such as route clearances or frequency change instructions, into other aircraft systems, such as the FMS or radios**

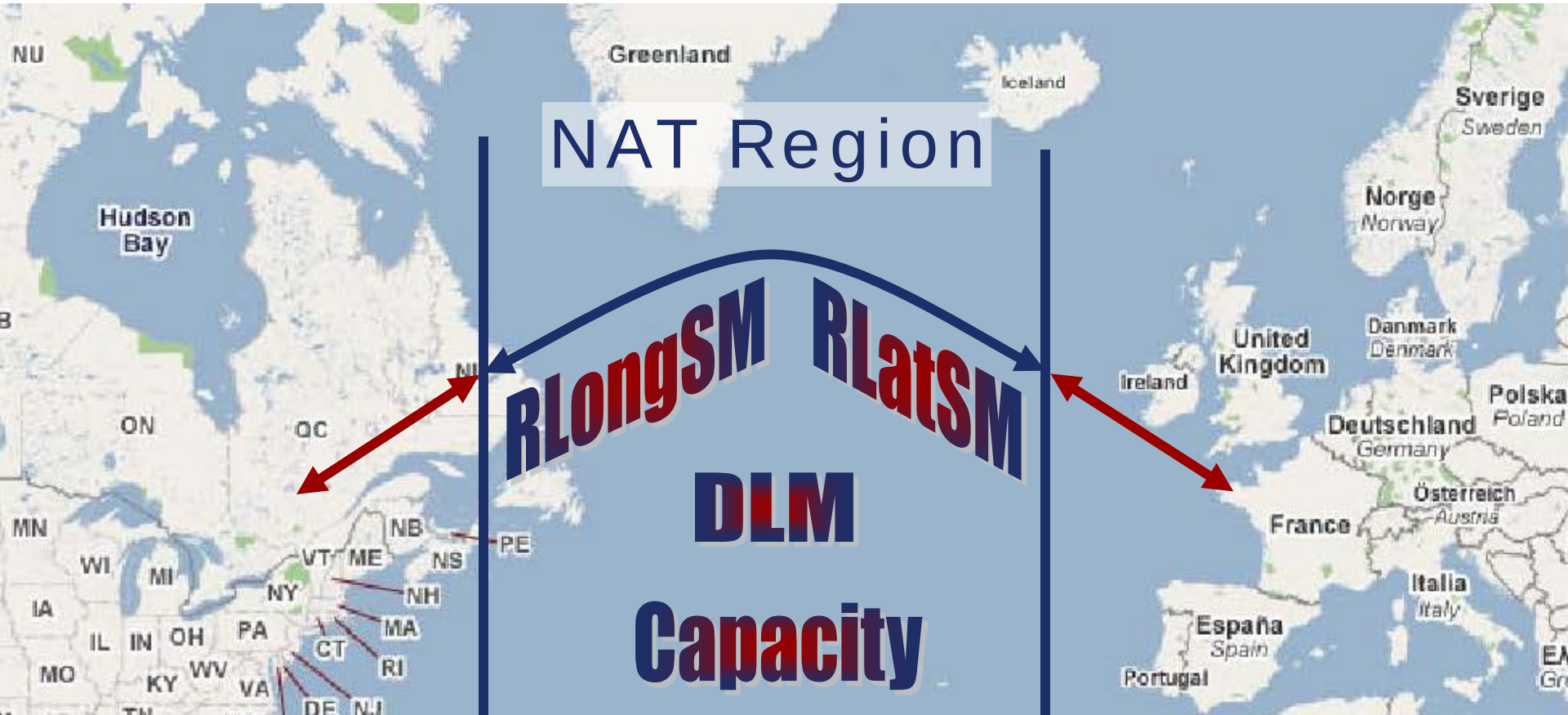
… and more BENEFITS

- **Allows the flight crew to request and load complex route clearances into to flight management system; allows the controller to respond to such requests without having to manually enter a long string of coordinates**
- **Potentially reduce flight crew workload – Allows the flight crew to automatically send reports as required by ATC, such as when crossing a compulsory reporting point**
- **Potentially reduce controller workload - Allows automatic flight plan updates based on information contained in specific downlink messages**

Safety BENEFIT – NAT Region – Vertical Operational Collision Risk Estimates



Air traffic management operations are becoming more dependent on communication and surveillance capabilities and performances



… and even more BENEFITS

- **Application of “procedural” performance-based separation minima**
  - 30 NM and 50 NM longitudinal
  - 5 minute longitudinal (RLongSM)
  - 23 NM lateral (formerly 30 NM lateral) (RLatSM in NAT OTS)
- **ADS-C Climb/Descent Procedure (ADS-C CDP)**
- **ADS-B In Trail Procedure (ADS-B ITP)**
- **User Preferred Routes (UPR)**
- **Dynamic Airborne Reroute Procedure (DARP)**

GOLD Manual (Doc 10037, Edition 1)

Region GOLD Ref	Doc 10037 Ref	Description
Foreword		Publications
Chapter 1		Abbreviations and acronyms
Chapter 1		Glossary
Chapter 2	Chapter 1.	Overview of data link operations
Chapter 3	Chapter 2	Administrative provisions related to data link operations
Chapter 4	Chapter 3	Controller and radio operator procedures
Chapter 5	Chapter 4	Flight crew procedures
Chapter 6	Chapter 5	Advanced ATS supported by data link
Chapter 7	Chapter 6	State aircraft data link operations
Appendix A	Appendix A	CPDLC message set
Apx B, C & D	N/A	Moved to PBCS Manual
Appendix E	Appendix B	Regional/State specific information
Appendix F	Appendix C	Operator/aircraft specific information

ICAO PBCS Provision

Applicable November 2016

- ✓ **June 2015 – ICAO completed proposed PBCS concept**
  - Required communication performance (RCP) 240
  - Required surveillance performance (RSP) 180
- **Relevant ATM operations include**
  - 50 NM, 30 NM and 5-minute longitudinal separation minima
  - 23 NM lateral separation minimum (formerly 30 NM lateral)

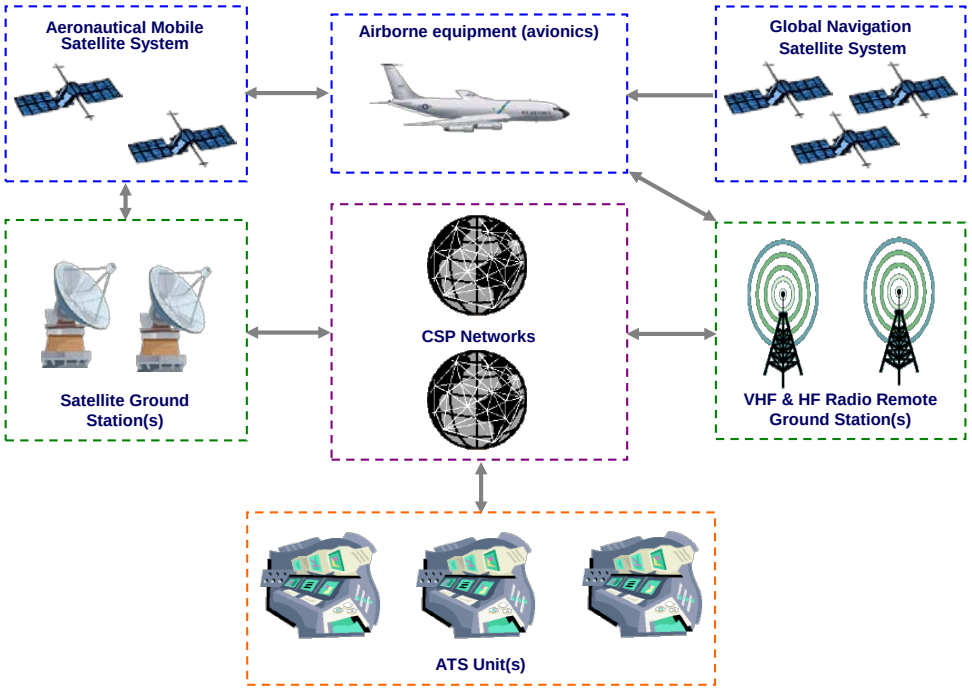
Requires State to	ANSP	Aircraft Operator
❑ Establish PBCS policies for ANSP, Aircraft Operator, etc ❑ Prescribe PBCS specifications in the applicable airspace for the relevant ATM operations	❑ Provides PBCS-compliant services ❑ Establishes PBCS monitoring program ❑ Publishes requirements in AIP (e.g. filing PBCS capabilities in flight plan)	❑ Obtains operational approval to file PBCS capability in flight plan ❑ Participates in ANSP PBCS monitoring programs

PBCS Implementation Plan – Checklist

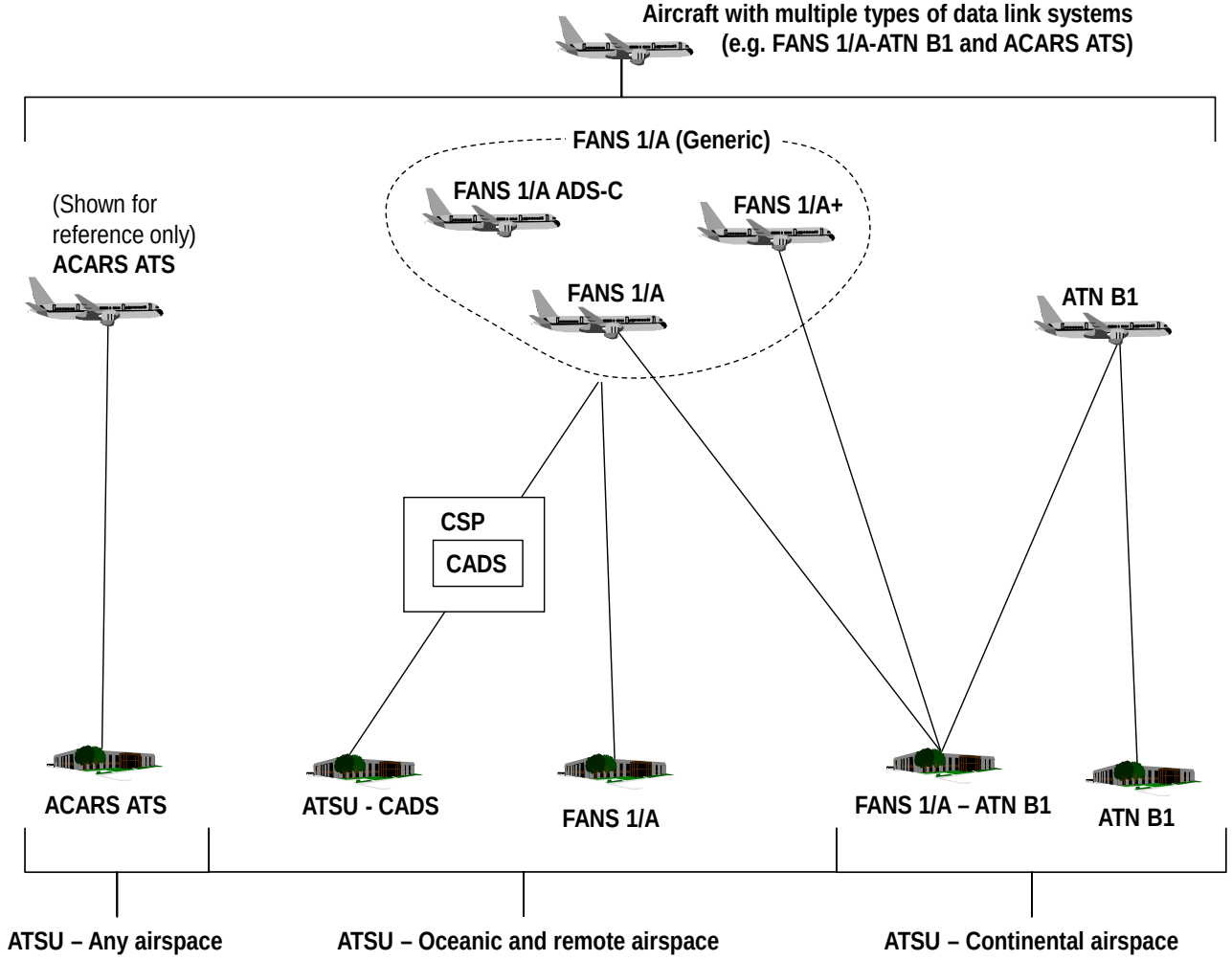
Task ID	Task Descriptor
Group A tasks – State/Region preparation	
A-1	AIP – Prescription of an RCP/RSP specification
A-2	ANSP – PBCS policies, objectives supporting safety oversight
A-3	Operator and Aircraft System – PBCS policies, objectives supporting safety oversight
A-4	Regional Supplementary Procedures (Doc 7030) for PBCS operations, if applicable
Group B tasks – ANSP general project development and management	
B-1	PBCS Implementation Plan
B-2	Target dates for PBCS and relevant ATM operations
B-3	RCP/RSP specifications
B-4	PBCS awareness
Group C tasks – ANSP implementation activities – ATS service provision	
C-1	Operational concepts and procedures for PBCS operations
C-2	ATC automation changes to use flight plan RCP/RSP indicators
C-3	ATC automation changes for PBCS monitoring
C-4	Confirm initial ANSP compliance with RCP/RSP specifications
Group D tasks – Aircraft operator, Aircraft type/system (airworthiness) eligibility	
D-1	Aircraft operator readiness
D-2	Confirm initial operator and/or aircraft type/system compliance with RCP/RSP specifications
Group E tasks – All stakeholders – post-implementation monitoring	
E-1	PBCS monitoring – post-implementation

Overview of a data link system

- **A data link system is a very complex set of hardware, software, people, procedures, … in a multi-institutional environment**



Different ATS unit/aircraft interoperable connectivity – further complicates matters



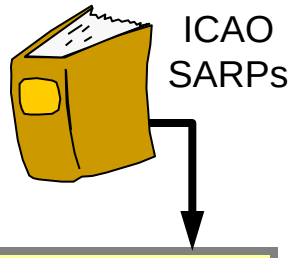
Interoperability and variation

- **Interoperability standards**
  - FANS 1/A, ATN B1 or ATN B1-FANS 1/A
  - Inmarsat Classic Aero, Iridium Short Burst Data, VDL Mode 0/A, VDL Mode 2 and HFDL
- **Interoperability standards allow operators to make choices that can affect operational performance**
  - Different technologies
  - Different implementations

Safety oversight framework

- **Initial approvals**
  - Aircraft system design
  - ATS provision (includes CSP/SSP)
  - Operator (includes CSP/SSP)
- **Post-implementation monitoring**
  - Component and sub-component analysis
  - Change management
  - Continuous improvement – corrective action

Safety oversight framework



Appropriate Authority

Regional/National
Safety Rules

Air
Navigation
Services

Airworthiness,
Operations and
Maintenance

ANSP

Aeronautical
Station and/or
ATSU

Service
Agreement

CSP

Network
Access

Dedicated
Network

Service
Agreement

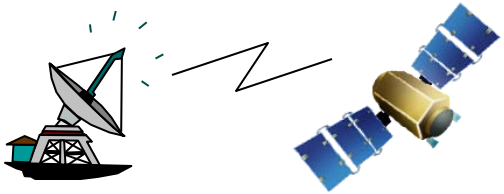
**Aircraft
Operator**

Aircraft

AOC

Service Agreement

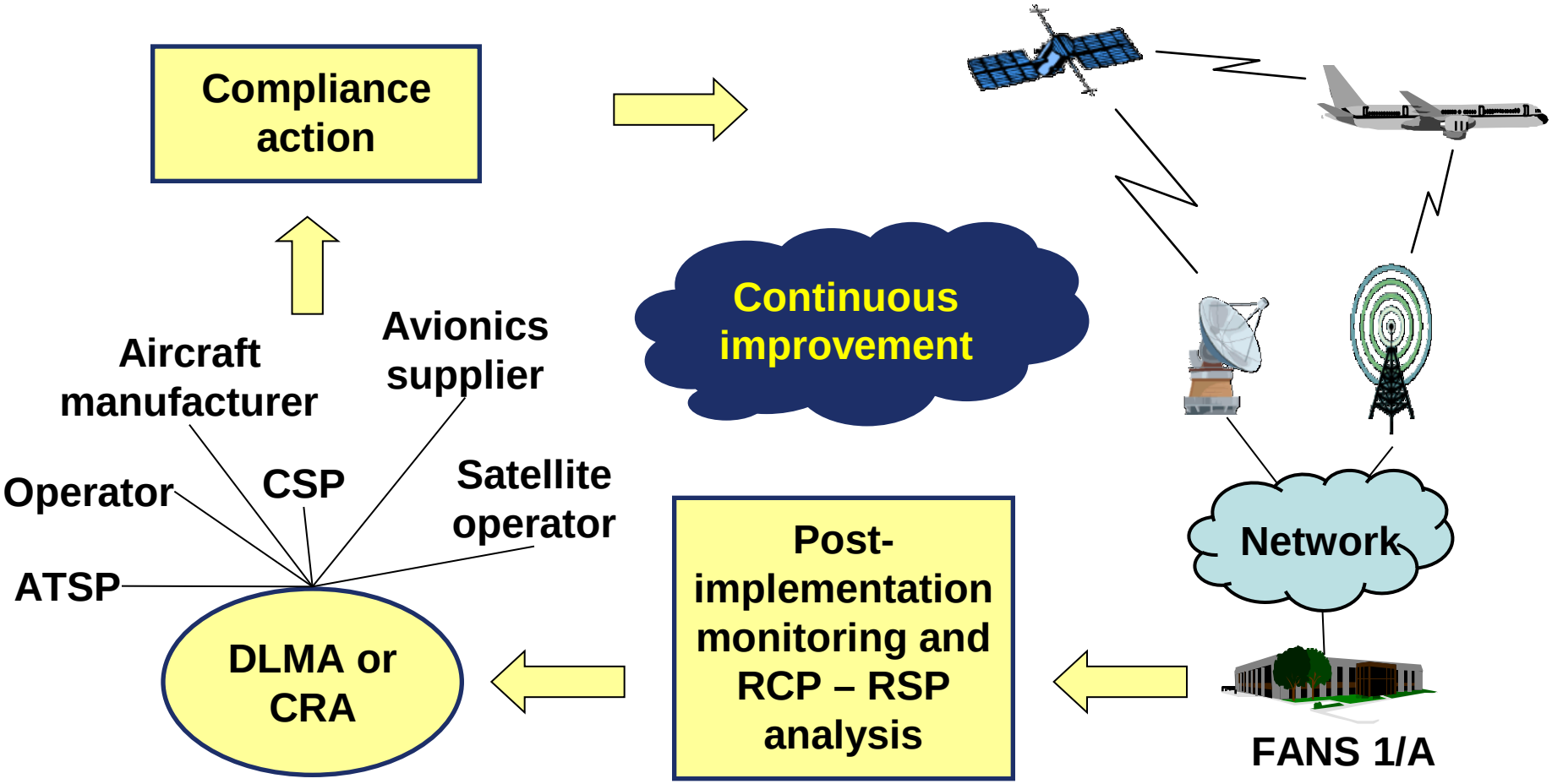
SSP



Earth Station

Satellite

Does the region have a way to manage change and performance



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FIND **problems**

and

FIX **them**