

# Data Link Benefits

## CPDLC, ADS-C and Satellite



Federal Aviation  
Administration

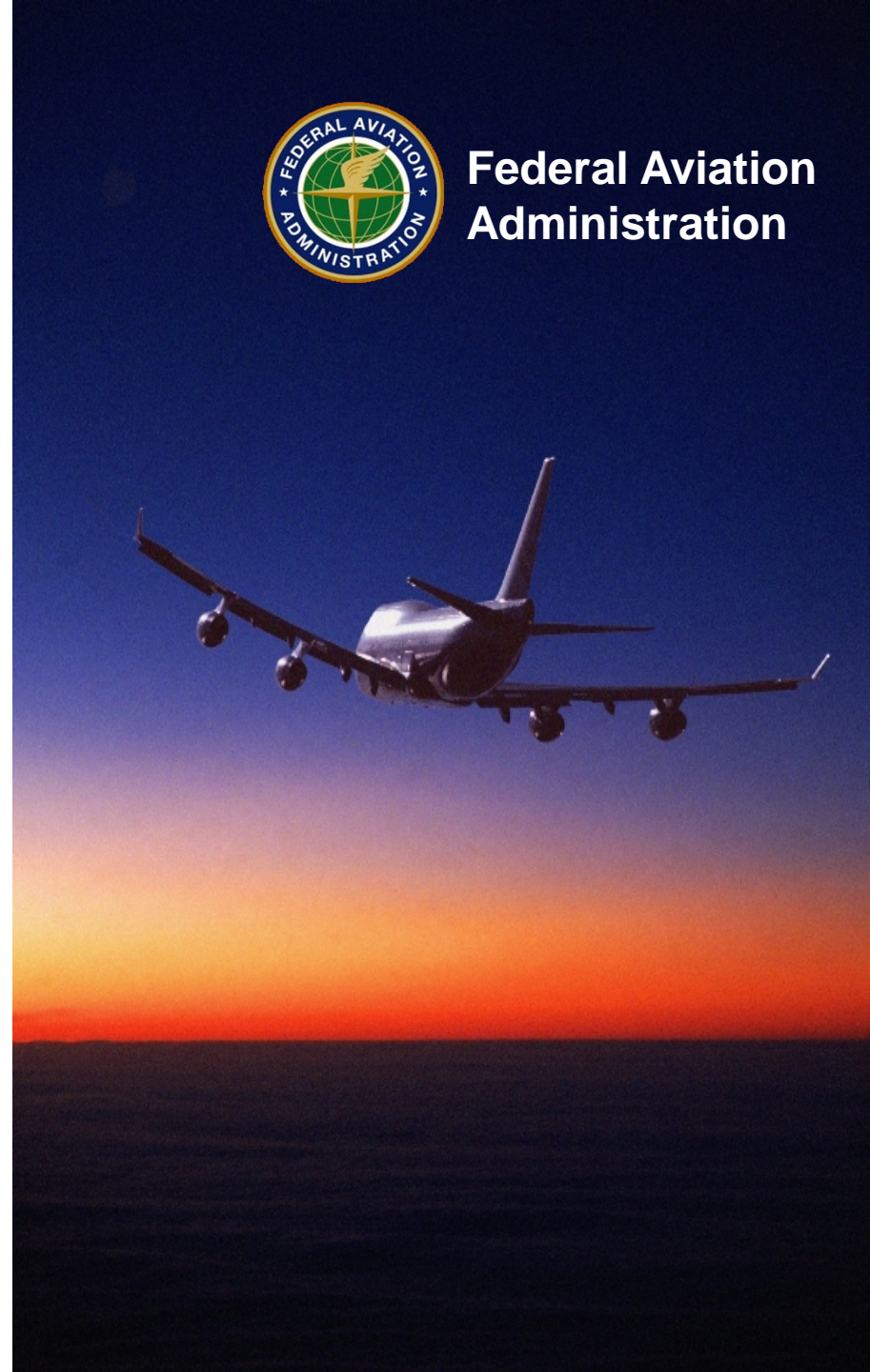
Presented to:

ICAO Seminar/Workshop on the  
Implementation of Ground-ground  
and Air-ground Data Links in the  
SAM Region

By: Tom Kraft

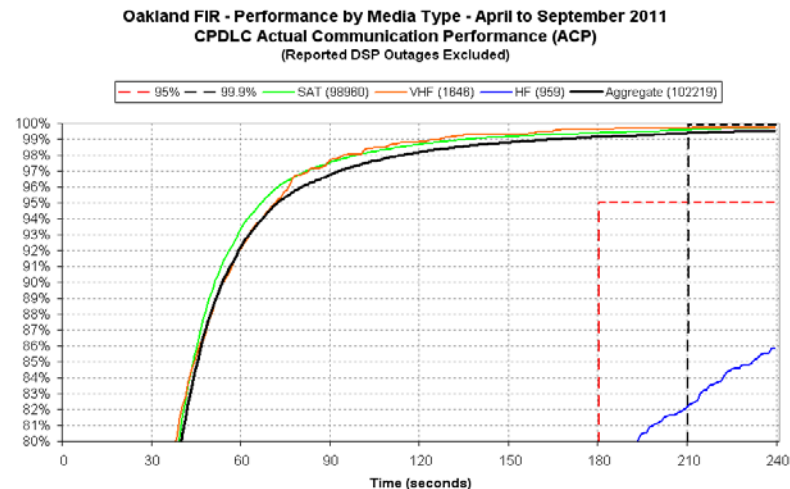
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Date: 12 September 2012



# CPDLC (Data Link) Benefits

- **Aircraft message exchange time is reduced**
  - Clearances via HF radio operator must be delivered within 3 min
  - Actual Communication Performance (ACP)
    - Total time required by the communication transaction
    - Begins when controller sends CPDLC message to aircraft
    - Ends when controller receives indication of the WILCO



# CPDLC (Data Link) Benefits

- **Data Link communications provides a direct link to the aircraft**
- **Communication via HF Radio operator relay is removed**
  - Safety is increased when messages are not repeated by HF radio operator
  - Errors can occur each time a message is verbally repeated



# CPDLC (Data Link) Benefits

- **CPDLC clearances use a clearly defined message set**
- **The standardized clearance message set reduces the chance of misinterpretation**
- **Readback/Hearback errors are removed**
- **Provides capability to load route clearance information directly into the FMS**



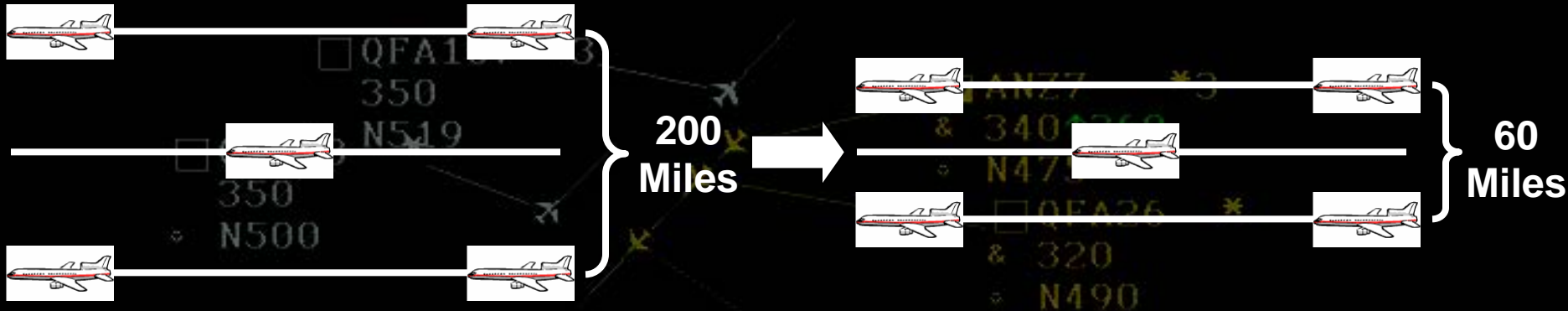
# ADS-C (Data Link) Benefits

- **More frequent and accurate position reports are received via ADS-C**
- **ADS-C contract rate can be increased in emergency situations**
- **Event contracts alert ATC when aircraft are deviating from their cleared profile**

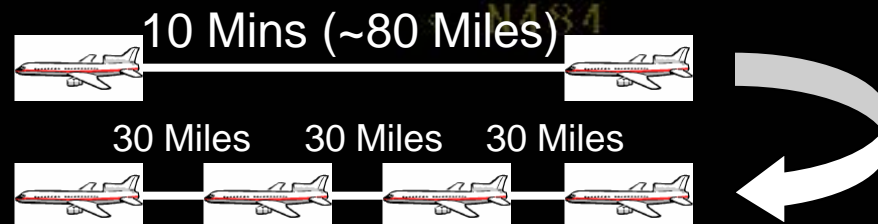


# CPDLC/ADS-C (Data Link) Benefits

## Lateral Separation



## Longitudinal Separation



# Satellite Data Link Benefits

- **Satellite Data Link Communications are more reliable than HF voice communications**
  - HF Communications Atmospheric Conditions
  - Solar Flares
  - Multiple ATC Facilities use the same frequency

# Satellite Data Link Benefits

- **Satellite Data Link reduces HF congestion**
- **When traffic levels are high, aircraft may have to wait to transmit their messages**
- **FANS equipped aircraft do not compete for band width on the HF frequencies under normal conditions**





# Satellite Data Link Benefits

- **Satellite Data Link makes more advanced procedure possible**
  - Dynamic Airborne Reroute Procedure (DARP)
    - Controller sends route re-clearance to aircraft to obtain a new more efficient route
  - Tailored Arrivals
    - Controller sends an optimized profile descent to the aircraft
  - ADS-C Climb Descent Procedure (CDP)
    - Controller sends climb/descend clearance to aircraft through a flight level with a blocking aircraft to within 16 NM

# Global standardization of data link

- **Global standards and guidance will facilitate maximum benefits from data link implementation**
  - ICAO Standards and Recommended Practices
  - Global Operational Data Link Document (GOLD)





# Data Link Operations

## CPDLC and ADS-C



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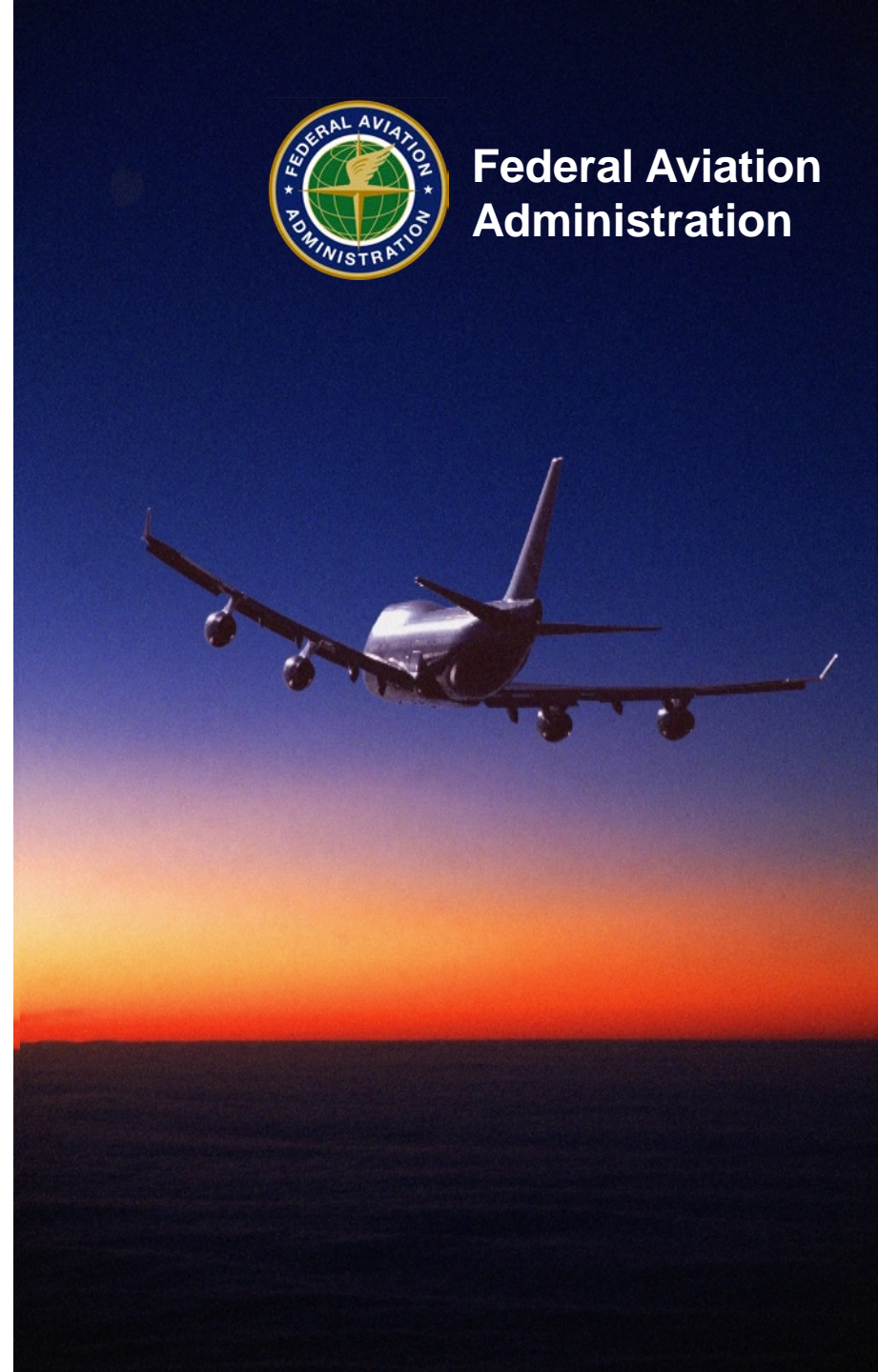
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# Data Link Operations

- **Procedures for the use of Data Link are covered in the GOLD and other ICAO Docs**
- **The procedures for data link operations are very detailed and very developed over years of operational experience**
- **There is not time to cover all of the procedures in this briefing**
- **ANSPs and Operators utilizing data link should operate via these procedures**



# Data Link Operations

- **ICAO Doc 4444, PANS ATM Contains extensive guidance on the use of Data Link.**
- **Chapter 4.15 Data Link Communications Initiations Procedures**





# Data Link Operations

- ICAO Doc 4444, Chapter 5
- Contains procedural information on the application of ADS-C Distance Based Separation Standards



# Data Link Operations

- **ICAO Doc 4444, PANS ATM**
- **Chapter 13 Automatic Dependant Surveillance Contract (ADS-C) Services**
  - Use of ADS-C in ATC Systems
  - Conformance Monitoring
  - Human Factors
  - Presentation of data
  - Coordination and Transfer of Control
  - Contract Management
  - Performance Checks
  - Emergency, Urgency Reports
  - Equipment Failure
  - Use of ADS-C in the Application of Separation

# Data Link Operations

- **ICAO Doc 4444, PANS ATM**
- **Chapter 14 Controller-Pilot Data Link Communications (CPDLC)**
  - General CPDLC Requirements
  - Establishment of CPDLC
  - Exchange of Operational CPDLC Messages



# Data Link Operations

- **ICAO Doc 4444, PANS ATM**
- **Appendix 5 CPDLC Message Set**
  - Uplink Messages and attributes
  - Downlink Messages and Attributes
- **Use of the CPDLC message set is imperative when a message exists**
- **Difficult to create new messages**



# Data Link Operations

- **ICAO Doc 9613, Performance-based Navigation (PBN) Manual**
  - Guidance material for the implementation of the navigation capability supporting 93 km (50 nm) and 55.5 km (30 nm) separation standards



# Data Link Operations

- **ICAO Doc 9869, Manual on Required Communication Performance (RCP)**
- **Guidance material for the implementation of the communication capability supporting 93 km (50 nm) and 55.5 km (30 nm) separation standards**



# Data Link Operations

- **ICAO Doc 9689, Manual on Airspace Planning Methodology for the Determination of Separation Minima.**
- **Detailed information on the analysis used to determine separation minima and on performing safety assessments.**

# Data Link Operations

- **ICAO Annex 2, Rules of the Air**
- **ICAO Annex 11, Air Traffic Services**

# Data Link Operations

- **ICAO GOLD, Global Operational Data Link Document**
  - The GOLD guidance material “is intended to maximize operational benefits in data link operations by promoting seamless and interoperable data link operations throughout the world.”









# GOLD

## Introduction

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# GOLD

# Introduction

- **GOLD implementation**
  - Service provision and operator readiness
  - Procedures
  - RCP/RSP implementation
- **Plans for a follow-on work program to amend the GOLD**
  - Complete a GOLD, 2nd Edition, → 1<sup>st</sup> Quarter 2013



# Current GOLD status

- **In June 2010, North Atlantic (NAT) Region, Asia-Pacific (APAC) Regions and South Atlantic (SAT) sub-Region adopted GOLD**
- **GOLD now supersedes**
  - Guidance Material for ATS Data Link Services in NAT Airspace (NAT Data Link GM)
  - FANS 1/A Operations Manual (FOM), which was used throughout APAC Regions, and African-Indian Ocean (AFI) and South American (SAM) Regions



# GOLD contents overview

- **Guidance on data link service provision**
- **Guidance on operator preparation/aircraft equipage**
- **Guidance on controller and flight crew procedures**
- **Performance-based specifications for communications and surveillance**
- **Guidance on post-implementation monitoring and corrective actions**



# GOLD contents (1 of 3)

- **Structured like an ICAO Manual**
- **Designed for usability in operational planning and implementation**

Material Type	Reference	Description	Intended uses, remarks
Introductory material	Foreword	Purpose, scope, etc.	For all users of the document. Descriptive.
	Chapter 1	Definitions	For all users of the document. Descriptive.
	Chapter 2	Overview of data link operations	For ANSPs and operators to develop training material for personnel, as appropriate, on the fundamentals of data link operations. Descriptive.





# GOLD contents (2 of 3)

Material Type	Reference	Description	Intended uses, remarks
<b>Guidelines</b>	Chapter 3	Administrative provisions related to data link operations	For ANSPs and airspace planners to plan for and implement data link services, including ATC automation, and interfacility agreements. For ANSPs and operators to negotiate contractual arrangements with CSPs. For operators to plan for and use the data link system.
	Chapter 4	Controller and radio operator procedures	For ANSPs and CSPs to develop procedures and training material for controllers and other personnel at ATSUs and radio facilities.
	Chapter 5	Flight crew procedures	For operators to develop procedures and training material for the flight crew and dispatchers.
	Chapter 6	Advanced data link operations	For ANSPs and operators to develop procedures and training material for personnel, as appropriate, related to advanced data link operations, such as dynamic airborne reroute procedures (DARP) and tailored arrival (TA).
	Chapter 7	State aircraft data link operations	For ANSPs and State (military) operators to develop procedures and training material for personnel, as appropriate, related to conducting military operations, such as military assumes responsibility for the separation of aircraft (MARSA) and air-to-air refueling (AAR).





# GOLD contents (3 of 3)

Material Type	Reference	Description	Intended uses, remarks
<b>Appendices (Supporting and Additional Guidelines)</b>	Appendix A	CPDLC message elements and standardized free text messages	For all users. Based on Doc 4444, and includes FANS 1/A and ATN B1 messages.
	Appendix B	RCP specifications	For technical operations specialists, applies to CPDLC, particularly in reduced separation environments.
	Appendix C	Surveillance performance specifications	For technical operations specialists, applies to ADS-C and FMC WPR, particularly in reduced separation environments.
	Appendix D	Post-implementation monitoring and corrective action	For post-implementation monitoring of the performance of the data link system, analysis, investigations, and corrective action at the the State/ANSP, regional, and global levels.
	Appendix E	Regional/State-specific information	Includes differences in data link operations at the State/ANSP and regional levels.
	Appendix F	Operator/aircraft specific information	Includes differences in aircraft data link system capability and performance.



# GOLD availability

- This document is available from the following web sites:
  - <http://www.ispacg-cra.com>
  - [http://www.faa.gov/about/office\\_org/headquarters\\_of\\_fices/ato/service\\_units/enroute/oceanic/data\\_link/](http://www.faa.gov/about/office_org/headquarters_of_fices/ato/service_units/enroute/oceanic/data_link/)
- This website provides repository for GOLD performance analysis, problem reports and corrective actions



# Summary

- **GOLD is proving to be a significant activity to converge data link implementations worldwide**
- **We all need to participate and contribute to improve its usefulness**





