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ICAO Standards and Guidance Material on Datalink for ATS Operations

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Presenter Title

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Aim of this Presentation

- To inform you about the current, relevant ICAO provisions on Data Link Communications by describing their;
 - **CONTENT.**
 - **ROLE**
 - **HISTORY.**
- Then to discuss future plans and need for Standards and Guidance Material



Two Aspects to Data Link ⁽¹⁾

- The “*Message*”
 - *In other words, the message “Content” and “Procedures”*
 - *Handled by the OPLINKP (now the OPDLWG)*
 - *Much of it based on using FANS-1/A.*
 - *That will soon change!*





Two Aspects to Data Link ⁽²⁾

- The “*Medium*”
 - *Handled by the ACP (now the DCIWG)*
 - *Work focused on various media and the network supporting them:*
 - *ATN, VDL-Mode 2, AMS(R)S, etc.*





OPDLWG and DCIWG???

A few quick words.

- In 2014, the Communications Panel (CP) was formed by the merging of the ACP and OPLINKP.
- The CP has two “specific” Working Group
 - ***Data Communications Infrastructure Working Group***
 - Former ACP, dealing with Technical Issues
 - ***Operational Data Link Working Group***
 - Former OPLINKP, dealing with Operational Issues



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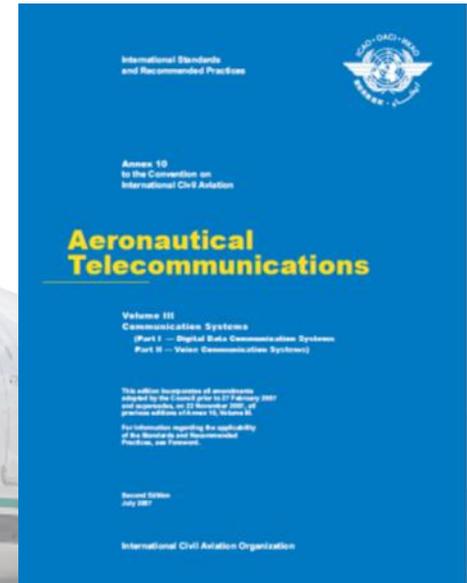
A closer look at the Standards supporting the “Media” and their history.





ICAO Standards and Guidance

- For the Media....
 - Annex 10 Volume III is the key “standards” document.
- *However this is 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*



Doc 9880

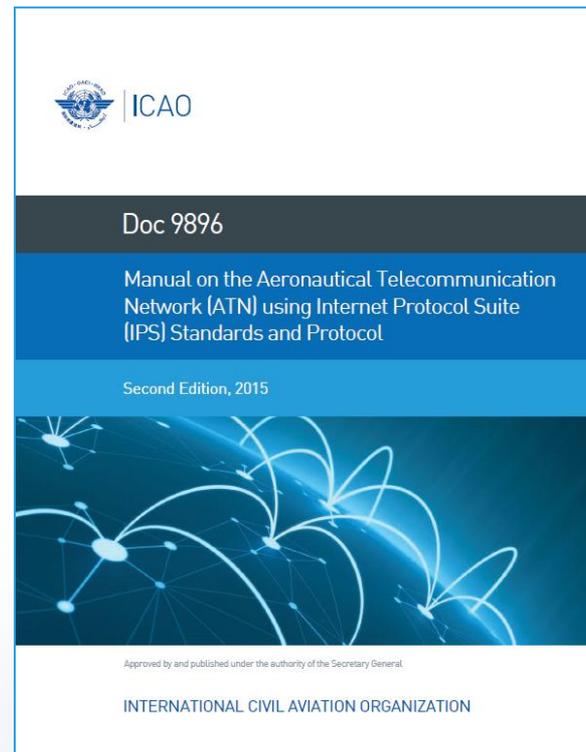
- 4 Parts
 - Air-Ground Applications
 - CPDLC, CM, ADS-C (tbd), FIS (tbd)
 - Ground-Ground Applications
 - AMHS, AFTN/AMHS Gateway
 - Upper-Layer Communications Services; Internet Communications Services
 - Directory Services, Security and Identifier Registration.
- 2nd Edition – late 2016.





Doc 9896

- Contains 3 parts:
 - Detailed Tech Specs
 - Network, Transport and Security
 - IPS Applications
 - VOIP
 - Including *convergence functions* for legacy (OSI) applications.
 - Guidance Material
- 2nd Edition - 2015





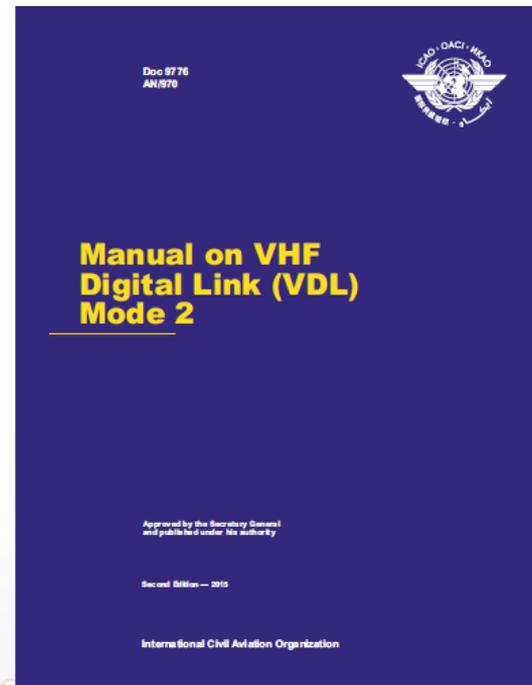
ICAO Manuals on Data Link Media ⁽²⁾

- 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: *VDL Mode-2*

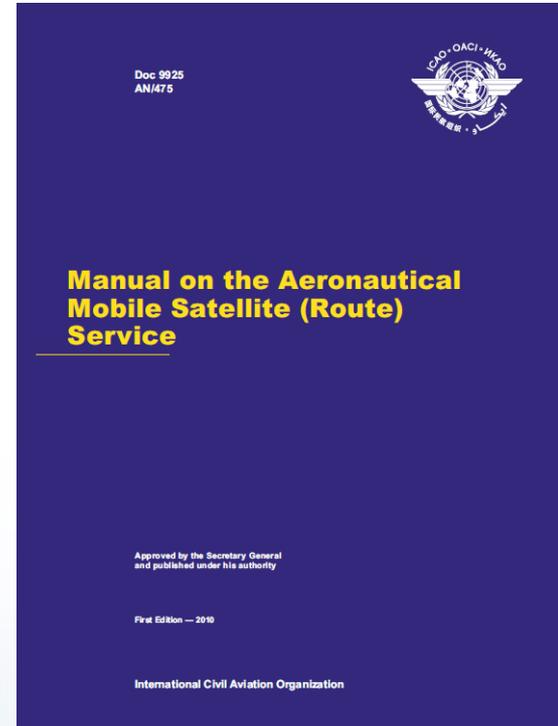
- 2nd Edition in 2015
 - Has multi-frequency support for NextGen/SESAR
 - Solves congestion-based problems to date.
- Is OSI-based and is part of LINK2000.





Doc 9925

- First Edition
 - INMARSAT Classic,
 - ACARS-based plus supports OSI but never used.
 - Iridium
 - ACARS-based
- 2nd Edition - late 2016
 - SwiftBroadband (SBB)
 - Supports ACARS and IPS





Doc 10044: *AeroMACS*

- First Edition due late 2016
 - A10 SARPS become applicable at that time.
- Supports IPS
 - Manual will have provisions on Security
 - Also guidance on operation before ATN/IPS becomes operational



There are many more!!!

- Some are still current but are only suitable for regional implementations.
- Many other documents have become **OBSOLETE!!**

To understand why let's examine some history.



Some History

- The “*Media*”:
- *We have had a chequered history!!!*
 - The basic technology has moved from OSI to IPS
 - The air-ground link is moving from ACARS to OSI to IPS.
- *Let’s try to make sense of this!!!*



OSI to IPS???

- In 1986 – A new network for Air-Ground and Ground-Ground data communications – *using OSI!*

The Aeronautical Telecommunications Network (ATN)

- Accepted in 1991 by the 10th Air Navigation Conference.



The ATN

- In simple terms
 - Supports many media
 - Modern transfer (charts, images, files)
- Can support ATFM, SWIM, CDM, Graphic weather, Airline traffic, etc.





So What Happened?





It didn't end there...

WHY?

*The mid-90s onwards saw the explosion of the **internet!***

By the end of the decade the Internet Protocol Suite became the de facto

- **The IT industry embraced this as it helped their business!**

Industry Standard!

- *The IP protocols were simple and understood.*
- *In many cases, they could provide the user equipment and the network equipment!*



ICAO's Response???

(1)

- *Amendment 83 to Annex 10 accepted by the Council in March 2008*
 - *Considered OSI and IPS*





ICAO's Response???

(2)

- The ATN Manual using IPS (Doc. 9896) was born
 - *20 years of work had to be revisited!*
 - *Hence many docs now obsolete.*
 - *Please consult list to find out more.*



Doc 9880 (cont'd)

If OSI protocols no longer supported, why do we need this manual???

Two Reasons:

- Applications already defined under OSI conventions:
 - CPDLC, CM, ADS-C, AMHS
- LINK 2000 and planned avionics architectures will use this. (*more later*)
- VDL Mode-2 is defined under OSI conventions.



The Air-Ground Link

- **Three types of aircraft today :**
 - ARINC 623 – D-ATIS, PDC/DCL, OCL
 - *All character based : **short-lived.***
 - FANS-1/A – CPDLC, ADS
 - *with full integration into Flight Management System*
 - LINK 2000+ aircraft – Limited CPDLC Message Set.
 - *No integration into Flight Management System*
 - ***BUT – only LINK 2000 are compliant with ICAO standards!***



FANS-1/A

- Communication performance adequate for Oceanic and Remote use
 - *Hence most use made over high seas – Pacific and North Atlantic.*
- Communication performance not adequate for high-density en-route and terminal areas
- Some exceptions – *Tailored Arrivals.*
- Can participate in LINK 2000+ programme
 - *More on that later.*





How did this happen??

- In the early '90s, airlines wanted to exploit ACARS for short-term benefits.
 - Especially in Oceanic Airspace.
- ICAO standards were a “work in progress”,
 - so industry went ahead with the development of FANS-1/A
 - *Using ACARS and industry versions of CPDLC and ADS*





Now Let's Look at the Standards and Guidance supporting the "Message"





Some Background

- The ADS Panel developed, ICAO standards for CPDLC, ADS-C and Data Link Initiation Capability (DLIC).
- In 2000, the ADS Panel then became the Operational Data Link Panel (OPLINKP).
- In 2014, OPLINKP became the Operational Data Link Working Group (OPDLWG).

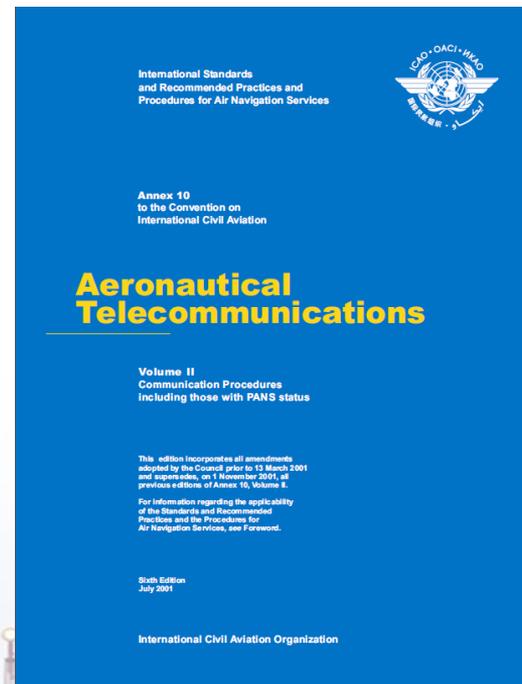


ICAO Standards

Annex 10, Volume II

Chapter 8 Aeronautical Mobile Service – Data Link Communications

- Composition of data link messages
- Display of data link messages
- CPDLC procedures





ICAO Standards

Annex 6, Operation of Aircraft

Annex 11, Air Traffic Services and

Annex 15, Aeronautical Information Services.

- Can also be affected.





ICAO PANS and Guidance

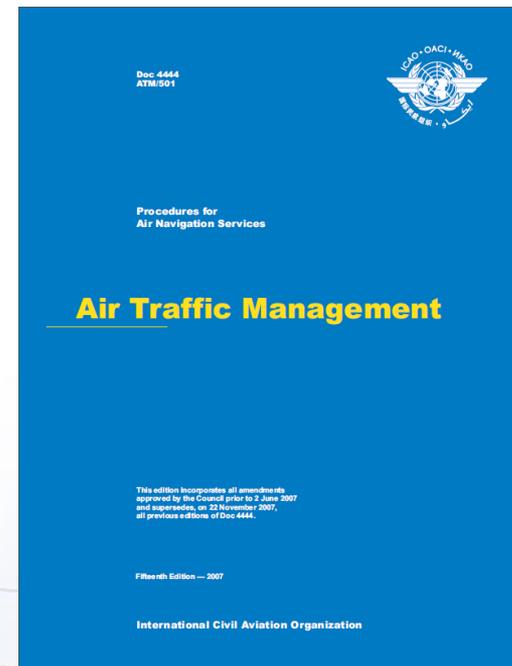
- **Doc. 4444** : *PANS-ATM*
- **Doc. 10037** : *Global Operational Data Link (GOLD) Manual*
- **Doc. 9869** : *Performance-Based Communication and Surveillance Manual*



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

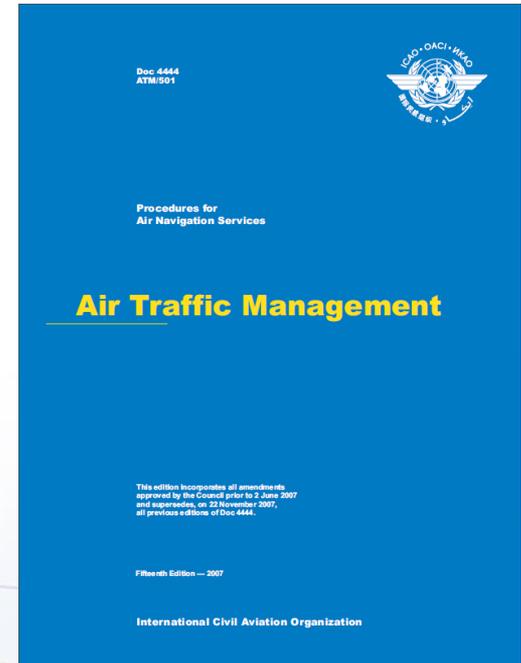




PANS-ATM (Doc 4444)

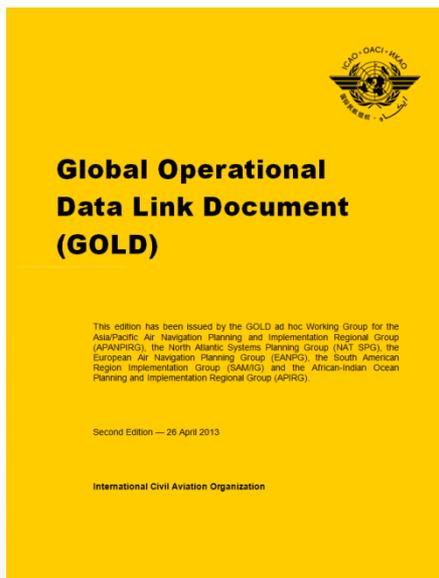
Chapter 13 ADS-C Services

- 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





Global Operational Data Link Manual (Doc 10037)



- 1st Edition, addressing current implementation (FANS-/1 and ATN B1) to be published in July/August 2016.
- The work for 2nd Edition, addressing current and **future** services (FANS-1/A, ATNB1 & B2) is already in progress



Global Operational Data Link Manual (Doc 10037, Edition 1)

Chapter 1. Overview of data link operations

Chapter 2. Administrative provisions related to data link operations

Chapter 3. Controller and radio operator procedures

Chapter 4. Flight crew procedures

Chapter 5. Advanced ATS supported by data link

Chapter 6. State aircraft data link operations

Appendix A CPDLC message elements and standardized free text message elements

Appendix B Regional/State specific information

Appendix C Operator/aircraft specific information



Global Operational Data Link Manual (Doc 10037)

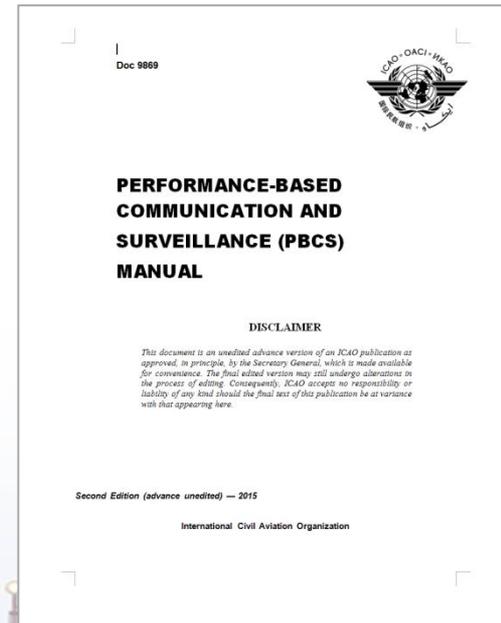
- New applications, new developments will reside in the GOLD
 - With supporting provisions in other documents.

GOLD literally is Data Link “GOLD”!!!



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
- To be published in July/August 2016





What Lies Ahead?

- Short, Medium and Long Term
 - Future concepts are evolving!
- Challenges!
 - Transition with different:
 - Timelines,
 - Technologies,
 - Capabilities,
 - Rates of Equipage.



Short Term

- Much work needed on ***Annex 10, Vol III*** and especially ***Doc 9896***, dealing with:
 - IP Mobility
 - An approach must be chosen.
 - Addressing and naming compatible with IPV6
 - Security
 - Including processes to support it.
- **Expected Completion – 2020**



Medium Term

- More work needed on ***Annex 10, Vol III*** and ***new manuals*** required for new media!
 - LDACS, a broadband terrestrial datalink
 - Capable of supporting digital voice and data, all using IPS.
 - A new Working Group – WG-Technology, to be established in 2016.
 - Future Satellite Systems
 - Capable of supporting high(er)-speed digital voice and data all using IPS
 - Voice could replicate Push-To-Talk!!
- Expected Completion – 2020's



Transition!?!?

- An issue short, medium and long-term.
 - IPv4 to IPv6 terrestrial networks.
 - Will not happen overnight. Careful selection of architecture needed.
 - OSI to IPS on air-ground link
 - Dual capability on aircraft – extremely complex, hence to be avoided!
 - Dual-stacks on ground, CP already considering requirements.
 - Work on “tunneling”, IPS over VDL-2 underway.
- **More overleaf.**



Transition ⁽²⁾

- Two approaches to OSI → IPS migration.
 - Wait for an all IPS communication infrastructure or
 - Hybrid approach. In other words, use both with “tunneling” or other adaptation.





Transition ⁽³⁾

- **Mixed capabilities on fleets, *i.e;* FANS, ATN B1, ATN B2**
Cannot be avoided.

- Airlines want a return on investment.
- Forward-fit least difficult
- Retro-fit = expense! (Aircraft life approx. 20 years!)

Creative Solutions Needed!!



Transition (4)

- The standards for the applications will evolve
 - Future concepts are evolving!
 - 4D Trajectory, Advanced - Interval Management, Dynamic RNP etc.
 - Message types, contents and formats **will change based on experience and lessons learnt.**
 - ***Hence new editions of the GOLD!***

Therefore...

Even More Creative Solutions Needed!!



How to decide on the way ahead???

- An all-compliant aircraft will not be available until 2025+.
 - IPS-based with the final ATN B2 capability.

Some suggestions for the meantime.



The way ahead (1).

- Look at the aircraft fleets in your Region.
 - How will they equip??
 - Oceanic or Regional??
 - Old or new aircraft??
 - FANS, OSI or hybrid?.
 - What benefits can be provided??
 - Greatest impact?
 - Largest number of aircraft??



The way ahead (2).

- Early experience is not wasted.
 - FANS-1/A taught us many lessons.
- Coping with change is the biggest challenge.
 - Software maintenance contracts for ground systems **must** be able to support regular updates, incremental changes to applications.

Ergonomics not Technology will determine success?



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Obrigado

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