ATS DATA LINK · TRAINING BRIEFING

CPDLC

Controller–Pilot Data Link Communications

Fundamentals, operational use and applications in oceanic, remote and continental airspace

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November 2026

Annex 11 | Doc 4444 (PANS-ATM) | Doc 9869 (PBCS)



ICAO | OACI

AGENDA

What this briefing covers

1. Fundamentals
2. Complementary functions
3. Operational use
4. Controller–pilot interaction
5. Voice versus data link
6. Oceanic, remote and continental applications
7. Benefits, limitations and typical scenarios

Reference documents

Annex 11

Air Traffic Services: communication requirements for ATS units

Doc 4444 (PANS-ATM)

Procedures for CPDLC and ADS-C, message sets and phraseology

Doc 9869 (PBCS)

Performance-based communication and surveillance: RCP and RSP

REGULATORY FRAMEWORK

Three documents, three layers of guidance

Annex 11

Standards: what ATS must provide

- Defines air traffic services and their communication requirements
- Provisions for air–ground communications, including data link
- Coordination and recording of ATS communications

Doc 4444 (PANS-ATM)

Procedures: how to operate

- Procedures for CPDLC and ADS-C services
- Message sets, response attributes and standard phraseology
- Contingency procedures when data link fails

Doc 9869 (PBCS)

Performance: how well it must work

- RCP and RSP performance specifications
- Guidance on approval, monitoring and corrective action
- Enables performance-based separation in oceanic and remote airspace

Together: the Annex sets the requirement, PANS-ATM sets the procedure, the PBCS Manual sets the performance.

CPDLC: clearances and requests as standardized text

DEFINITION

CPDLC lets controllers and pilots exchange ATC clearances, instructions, requests and reports as standardized data link messages.

Uplink (UM)

Controller to pilot: clearances, instructions, information

Downlink (DM)

Pilot to controller: requests, reports, responses

Standardized message set

Message elements with defined meaning, parameters and response attributes (Doc 4444)

Dialogue-based

Message identification and reference numbers link each reply to its originating message

Free text, used sparingly

Available for situations the standard set does not cover

Carried over ground–air networks

FANS 1/A over ACARS (VHF, SATCOM, HF) and ATN B1 over VDL Mode 2

How a message travels from controller to cockpit

Pilot
Flight deck display and input

Avionics
FMS / CDU and communications management

Air–ground link
VHF, SATCOM or HF data link

ATSU
Ground system that processes and routes messages

Controller
Working position and HMI

Logon (initiation)

The aircraft logs on to the ATSU, which correlates it with the flight plan before a CPDLC connection is established.

Current Data Authority

Only one ATSU at a time holds the active CPDLC connection and may exchange operational messages.

Next Data Authority (NDA)

The next ATSU is designated in advance so the connection can be transferred without a gap.

CPDLC works best alongside other data link services

Data link initiation

Logon establishes the link: aircraft identity, address and capabilities are exchanged with the ATSU.

ADS-C

Aircraft report position and intent automatically under contract: periodic, event and demand (Doc 4444).

AIDC

Ground–ground coordination and transfer between ATS units, supporting CDA/NDA handover.

D-ATIS

Aerodrome information delivered as text, easing frequency congestion.

Departure clearance

Pre-departure and departure clearances delivered by data link at the gate or on the ground.

PBCS monitoring

Measures actual communication and surveillance performance against RCP and RSP (Doc 9869).

The CPDLC life cycle, from logon to termination

1

Logon

Aircraft sends a logon to the ATSU, which correlates it with the flight plan.

2

Connect

The ATSU establishes the CPDLC connection and becomes the CDA.

3

Dialogue

Messages are exchanged; every dialogue is closed with a response.

4

Transfer

The NDA takes over at the boundary and becomes the new CDA.

5

Terminate

The connection ends once the aircraft has left the airspace.

Typical message categories

Clearances

Level, route and heading changes

Constraints

Speed, crossing points and offsets

Requests

Level change, route or weather deviation

Reports and alerts

Position reports and pilot-initiated emergency messages

Every message needs a response and closure

Standard pilot responses

WILCO	Instruction understood and will be complied with
UNABLE	Instruction cannot be complied with
STANDBY	Message received, response to follow; dialogue stays open
ROGER	Information received and understood
AFFIRM / NEGATIVE	Answer to a yes/no question

Controller

- Select the right message element and check its parameters
- Close each dialogue and follow up any STANDBY
- Switch to voice if no response arrives in time

Pilot

- Answer a CPDLC message through CPDLC
- Read and understand the message before responding
- Reply UNABLE when the instruction cannot be flown

Rule of thumb: a CPDLC message is answered by CPDLC; voice is used for urgent situations or to clarify.

Voice and data link are complementary, not competing

Criterion	Voice (VHF / HF)	CPDLC (data link)
Delivery	Real-time spoken exchange	Text message with transmission delay
Time-critical use	Preferred for urgent or conflict situations	Not suited to immediate action
Ambiguity	Risk of mishearing and readback errors	Text is displayed; risk of misreading or wrong selection
Situational awareness	Party line: other pilots hear the instruction	No party line: others do not see the message
Workload and capacity	Frequency congestion; relays needed on HF	Frees frequency; data can load into avionics
Record	Recording needs transcription	Time-stamped message log
Coverage	VHF is line of sight; HF quality varies	SATCOM and HF data link reach remote areas

Oceanic and remote: direct contact beyond radar

Beyond radar and VHF

- HF voice depends on radio operators and can be slow or noisy
- CPDLC gives the controller direct contact with the pilot
- ADS-C replaces radar as the source of position and intent
- Organized track systems rely on data link for clearances and reports

CPDLC with ADS-C

FANS 1/A is the common avionics baseline for oceanic and remote operations.

Reduced separation

Lateral and longitudinal minima, such as 50 NM and 30 NM, depend on approved RCP and RSP performance.

PBCS authorization

Aircraft and operators are approved against RCP and RSP specifications (Doc 9869).

Contingency

If CPDLC is lost, revert to voice (HF) using the procedures in Doc 4444.

Oceanic, remote and continental compared

Aspect	Oceanic	Remote	Continental
Typical network	FANS 1/A over SATCOM or HF data link	FANS 1/A over SATCOM, VHF data link where available	ATN B1 over VDL Mode 2, or FANS 1/A
Surveillance	ADS-C	ADS-C, with radar where available	Radar and ADS-B alongside CPDLC
Role of CPDLC	Primary means of controller–pilot contact	Primary or backup to HF voice	Supplements voice for routine messages
Performance basis	PBCS: RCP and RSP	PBCS: RCP and RSP	Regional and State requirements

In continental airspace voice stays primary for time-critical exchanges; CPDLC takes routine messages such as frequency changes and level or route clearances.

Doc 9869: performance is specified and monitored

RCP

Required Communication Performance

Sets what a controller–pilot communication transaction must achieve in time, continuity, availability and integrity, across the whole loop. Examples: RCP 240, RCP 400.

RSP

Required Surveillance Performance

Sets what surveillance data delivery, such as ADS-C reports, must achieve. Examples: RSP 180, RSP 400.

Performance management loop

Specify
Choose RCP and RSP for the airspace and separation minima

Approve
Authorize aircraft, operators and service providers

Monitor
Collect and analyse actual performance data

Correct
Investigate failures and apply corrective action

Clear gains for safety and capacity, with real constraints

Benefits

- Fewer misunderstandings from hearing and readback errors
- Less frequency congestion and lower workload
- Reliable contact in oceanic and remote airspace
- Supports reduced separation under PBCS
- Time-stamped message log for post-event review

Limitations

- Transmission delay makes it unsuitable for urgent action
- No party line: other aircraft do not see the message
- Needs equipage, approval and ground system investment
- Mixed equipage and outages require voice fallback
- Human factors: misreading or selecting the wrong message

Four typical scenarios and how CPDLC handles them

Oceanic level change

Pilot downlinks a level request. The controller checks traffic using ADS-C reports and uplinks the clearance. The pilot answers WILCO.

Weather deviation

Pilot requests a lateral deviation. The controller clears it by uplink. The pilot reports when back on the cleared route.

Boundary transfer

The NDA is designated, the connection is handed over and the pilot is told when to contact the next unit.

Data link failure

On loss of connection or no response, both sides revert to voice and follow the Doc 4444 contingency procedures.

KEY TAKEAWAYS

CPDLC complements voice; it does not replace it

1. **Annex 11, Doc 4444 and Doc 9869** set the requirement, the procedure and the performance.
2. **Closed dialogues** and clear responses keep controller–pilot exchanges safe.
3. **Oceanic and remote** airspace gain the most; continental use supplements voice.
4. **Voice remains the fallback** for urgent situations and for any data link failure.

Thank you. Questions?

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