AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WORKING GROUP 3 MEETING

Phuket, Thailand, 4 - 6 March 1997

Agenda Item 9: ANY OTHER BUSINESS

INTEGRATION OF ADS AND CPDLC IN THE NAT REGION - INTEGRATED SCENARIOS.

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1 Scope

1.1 This Information paper, originally prepared for the North Atlantic Implementation Management Group (NAT IMG) Air Traffic Management Group (ATMG) presents the integrated use of Automatic Dependent Surveillance (ADS) and Controller Pilot Data Link Communications (CPDLC) in the North Atlantic (NAT) region. The paper has been prepared in response to the action placed on the Chairman of SG2 at the 5th Meeting of WG 3, in Brisbane.

2 Introduction

2.1 Previous papers that have been submitted to many international forums have presented the potential isolated operation of ADS or CPDLC for air traffic control within the NAT region. It is however believed that the synergy that can be realised from the integrated use of both of these data link applications has the potential to far outweigh the benefits that could be realised from their independent operation. This paper presents a number of outline operational scenarios that show how the integrated use of ADS and CPDLC increase further the benefits of air/ground data link operations.

2.2 The paper assumes that only the Shanwick and Gander FIRs can support air/ground data link operations and that the *modus operandi* of air traffic control within the NAT region remains based on the concept of strategic control. Throughout the examples presented in this paper, NATS flight data processing system at its Oceanic Area Control Center (OACC) is referred to as FDPS2.

3 Example Operational Scenarios

3.1 The integrated use of the ADS and CPDLC applications is illustrated by the following scenarios of air traffic operations in the NAT region:

- Scenario 1: Baseline Scenario. The baseline scenario considers a routine flight across the NAT region. All subsequent scenarios use this baseline, but introduce an aspect to the flight that uses both ADS and CPDLC.

- Scenario 2: Detection of a Lateral Deviation. An aircraft deviates from its cleared track by more than 5 nm.

- Scenario 3: Detection of a Level Range Deviation. An aircraft deviates from its cleared level by more than 200 feet.

- Scenario 4: Request for a level change. An aircraft requests and receives a climb from FL330 to FL390. This scenario is presented in two parts: 4/1 uses the ADS application to report the progression of the aircraft during the climb phase, whilst 4/2 uses CPDLC to pass these messages.

- Scenario 5: Aircraft Emergency. An aircraft suffers an engine failure.

3.2 During a CPDLC dialogue, the receipt of a CPDLC message is acknowledged by the issue of a logical acknowledgment (LACK) message that is returned to the sender. For simplicity, the scenarios presented in this paper do not include the interchange of LACK messages.

Scenario 1: Baseline Scenario

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
90 minutes before entry into Shanwick FIR.	Aircrew initiate DLIC LOGON procedures to log-on to the FDPS2 by generating and transmitting a DLIC LOGON Request. The LOGON message will contain the aircraft-unique identifier (the 24 bit aircraft address) and the data link applications it can support. The aircraft does not have to be airborne to initiate the LOGON procedure.			The LOGON process will be either initiated manually by the aircrew or automatically by the avionics upon power-up. The process by which an aircraft logs on to a particular ground system is currently being developed by the ATN Panel; operational input from the ATMG would be appreciated. FDPS2 responds to the aircraft's request to receive a data link service. It correlates the aircraft-unique identifier with the aircraft identification stored in its database, registers the datalink capabilities supported by the aircraft and disseminates aircraft information to Flight Data Processing System (FDPS) at Gander via ground/ground communication links.
		A successful LOGON invokes the ADS application to issue an Initial Contact Agreement.	A successful LOGON invokes the CPDLC application to facilitate two way data communications when required.	

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
		FDPS2 automatically issues an ADS Initial Contact Agreement. This establishes an ADS Demand Contract for the immediate provision of the Basic Group, Extended Projected Profile (EPP) as stored in the FMS and Flight Identification group.		The EPP updates the flight plan stored within FDPS2. If an aircraft logs on and no flight plan is stored within FDPS2, a flight plan is created from the EPP.
	The avionics automatically sends the ADS Basic Group, EPP and Flight Identification group.			
		FDPS2 uses the EPP to determine the desired entry point into the Shanwick FIR.		
60 minutes before entry into Shanwick FIR.	The aircrew request the establishment of a CPDLC Downstream Data Authority (DDA) link with Shanwick Oceanic Area Control Center (OACC).			On establishment of the DDA link, FDPS2 will only permit access to those CPDLC message elements that comprise the Downstream Clearance (DSC) service, i.e. strategic rather than tactical message elements.
			Shanwick OACC automatically confirms the link establishment.	
		FDPS2 issues Pre-Shanwick (Domestic) ADS Agreement by establishing an ADS Periodic Contract for the provision of the Basic Group and EPP every 15 minutes.		FDPS2 uses the EPP information to check for any changes in boundary estimate. FDPS2 alerts the controller if an alteration to the time has occurred.
45 minutes before entry into Shanwick FIR.	The aircrew transmit requested Oceanic Clearance using the DDA link using the CPDLC DSC service.			DSC: Downstream Clearance. Only an aircraft can initiate the DSC service.

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
			FDPS2 receives CPDLC message requesting preferred Oceanic Clearance, including the point and time of entry into Shanwick FIR. FDPS2 passes the CPDLC message to the Controller. The controller determines the Oceanic Clearance, constructs the CPDLC response and authorises FDPS2 to send it to the aircraft.	The requested clearance is probed using FDPS2 to check for conflicts.
	The avionics receives the clearance and displays it to the aircrew. The aircrew update the clearance into the FMS (if necessary). The aircrew acknowledge receipt of the clearance by sending the CPDLC message WILCO.			The DDA link is not terminated by the aircrew. This is to allow for the potential of reclearances as a DDA link can only be aircrew initiated and if the link was terminated, the controller could not pass the reclearance message.
			The WILCO message is received by FDPS2. FDPS2 displays the WILCO message to the controller.	
5 minutes before cleared boundary time.				
		FDPS2 issues an ADS Demand Contract to check that the aircraft EPP matches the Oceanic Clearance.		

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
	The avionics sends the Basic Group and EPP.			
		FDPS2 performs conformance monitoring of the EPP against the cleared flight plan to confirm that clearance is input into FMS. FDPS2 issues ADS Boundary Agreement to establish an ADS Event Contract for the notification of a Waypoint Event (i.e. entering the Shanwick FIR), along with provision of the Basic Group and Projected Profile.		
Aircraft crosses the boundary and enters Shanwick FIR.				Shanwick becomes the Current Data Authority (CDA).
	Entry of the aircraft into the Shanwick FIR generates the issue of the waypoint event. The avionics sends notification on entry into Shanwick FIR, Basic Group and Projected Profile in accordance with the Boundary Agreement.			

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
		FDPS2 issues ADS Standard Agreement to establish the following contracts: <u>Periodic Contract:</u> Every 15 minutes the Basic Group and Projected Profile are to be reported. <u>Event Contract:</u> For the report of the following events: • Lateral Deviation Event (more than 5nm off track), provision of the Basic Group. • Level Range Deviation Event (more than 200ft above or below cleared level), provision of the Basic Group. • EPP Change Event, provision of the new EPP.		
			FDPS2 sends CPDLC message to the avionics advising that OACC is the CDA.	
	The avionics automatically terminates the DDA link (if open) upon detection that the DDA has become the CDA.			
Flight proceeds across Shanwick FIR.				

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
15 minutes from entry into Gander FIR.				
			FDPS2 instructs avionics to make DLIC CONTACT and establish a CPDLC NDA link with Gander.	NDA: Next Data Authority. This scenario assumes that there is no ground-ground data communications link between OACC and Gander.
	The avionics make DLIC CONTACT and established a CPDLC NDA link with Gander.			
		Gander FDPS automatically issues ADS Initial Contact Agreement.		
			Gander automatically confirms the establishment of the CPDLC NDA link. FDPS2 sends a CPDLC link end request to the aircraft.	
The aircraft leaves the Shanwick FIR and enters the Gander FIR.				
	A waypoint event is triggered and the ADS Basic Group sent to Gander in accordance with the ADS Initial Contact Agreement. The avionics automatically terminates the CPDLC link with Shanwick OACC, informs Shanwick of the termination of the link, enables its CPDLC CDA link with Gander and sends a Monitoring RT (MRT) message to Gander.			Gander is the CDA.
		Gander FDPS issues ADS Standard Agreement.		
Aircraft proceed along Gander FIR.				

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
15 minutes from entry into New York FIR.				
			Gander instructs the aircraft to contact New York on its voice channel be sending the CPDLC message CONTACT NEW YORK 128.275.	CPDLC message element 117.
	The aircrew acknowledge the instruction to establish voice communications with New York by sending CPDLC message WILCO.			
			Gander flight data processing facilities receive WILCO. Gander automatically sends a CPDLC link end request to the aircraft.	
	The avionics automatically terminates the CPDLC CDA link with Gander and informs Gander of the termination of the link.			
Aircraft leaves Gander FIR and passes into New York FIR.				
	A waypoint event is generated and sent to Gander advising that the aircraft has left the Gander FIR.			
		Gander terminates ADS contracts with aircraft.		
	The aircrew make voice contact with New York.			
The flight proceeds.				

Note: The process by which ATC Communications Management is performed is presented in Annex A.

Scenario 2: Detection of a Lateral Deviation Event.

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Aircraft on organised track in the Shanwick FIR.				
Time t = 0	The avionics detected that aircraft is more than 5 nm off track. A lateral deviation event report sent to Shanwick OACC in accordance with the requirements of the ADS Standard Agreement. The avionics repeat the lateral deviation event report once every minute while the deviation is present.			The lateral deviation is detected by continual comparison of the expected flight profile as stored in the ADS application with the navigational information in the FMS. The 5 nm threshold for the detection of a lateral deviation event was included as part of the ADS Standard Agreement.
Time t = 10 seconds		The lateral deviation event report is received by FDPS2.	The pre-formatted freetext CPDLC message is automatically sent to the aircraft by FDPS2 advising that A LATERAL DEVIATION EVENT HAS BEEN DETECTED. STANDBY FOR FURTHER INSTRUCTIONS.	This pre-formatted freetext message could be constructed using the freetext message element number 197 with the following attributes: Urgency: U Alert: M Response: W/U It is assumed that it takes a CPDLC message 10 seconds to reach FDPS2.
		FDPS2 alerts the controller that a lateral deviation event has been detected.	The pre-formatted CPDLC message is displayed to the controller.	

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Time t = 20 seconds	The avionics receive the CPDLC message advising that a lateral deviation event has been detected and displays it to the aircrew.			It is assumed that it takes the message 10 seconds to reach the avionics.
Time t = 30 seconds	The aircrew send CPDLC message WILCO.			
Time t = 40 seconds			The WILCO message is received by FDPS2 and displayed to the controller.	
			The controller constructs a CPDLC message to correct the deviation.	It is assumed that it takes the controller 60 seconds to construct the appropriate message.
Time t = 100 seconds			The controller authorises FDPS2 to issues the message to the aircraft.	
Time t = 110 seconds	The avionics receive the CPDLC message instructing the aircraft to take the appropriate action to rectify the lateral deviation and displays it to the aircrew.			
Time t = 120	The aircrew send CPDLC message WILCO.			
Time t = 125	The aircrew commence the appropriate maneuvering action.			
Time t = 130			The WILCO message is received by FDPS2 and displayed to the controller.	
Time t = 245 seconds Aircraft now within 5nm of track.	The reporting rate of the Standard Agreement is resumed.			It is assumed that it takes the aircraft 2 minutes to return to within 5 nm of the track.

Scenario 3: Detection of a Level Range Deviation Event.

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Aircraft on organised track in the Shanwick FIR.				
Time t = 0	The avionics detected that aircraft is more than 200ft above its cleared flight level. A Level Range Deviation (LRD) event report sent to Shanwick OACC in accordance with the requirements of the ADS Standard Agreement. The avionics repeat the LRD event report once every minute while the deviation is present.			The LRD event is detected by continual comparison of the expected flight profile as stored in the ADS application with the navigational information in the FMS. The 200 ft threshold for the detection of a LRD event was included as part of the ADS Standard Agreement.
Time t = 10 seconds		The LRD deviation event report is received by FDPS2.	The pre-formatted freetext CPDLC message is automatically sent to the aircraft by FDPS2 advising that A LEVEL RANGE DEVIATION EVENT HAS BEEN DETECTED. STANDBY FOR FURTHER INSTRUCTIONS.	This pre-formatted freetext message could be constructed using the freetext message element number 197 with the following attributes: Urgency: U Alert: M Response: W/U It is assumed that it takes a CPDLC message 10 seconds to reach FDPS2.
		FDPS2 alerts that controller that a LRD event has been detected.	The pre-formatted CPDLC message is displayed to the controller.	

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Time t = 20 seconds	The avionics receive the CPDLC message advising that a LRD event has been detected and displays it to the aircrew.			It is assumed that it takes the message 10 seconds to reach the avionics.
Time t = 30 seconds	The aircrew send CPDLC message WILCO.			
Time t = 40 seconds			The WILCO message is received by FDPS2 and displayed to the controller.	
			The controller constructs a CPDLC message to correct the deviation.	It is assumed that it takes the controller 60 seconds to construct the appropriate message.
Time t = 100 seconds			The controller authorises FDPS2 to issues the message to the aircraft.	
Time t = 110 seconds	The avionics receive the CPDLC message instructing the aircraft to take the appropriate action to rectify the LRD and displays it to the aircrew.			
Time t = 120	The aircrew send CPDLC message WILCO.			
Time t = 125	The aircrew commence the appropriate maneuvering action.			
Time t = 130			The WILCO message is received by FDPS2 and displayed to the controller.	
Time t = 155 seconds	The reporting rate of the ADS Standard Agreement is resumed.			It is assumed that it takes the aircraft 30 seconds to return to within 200 ft of the cleared flight level.
Aircraft now within 200 ft of cleared flight level.				

Scenario 4/1: Request for a Climb - ADS used to generate reports/confirmations.

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Aircraft on organised track in the Shanwick FIR at FL330.				
	The aircrew construct and send the following CPDLC message REQUEST CLIMB TO FL390.			CPDLC message element 9. Shanwick is the CDA.
			FDPS2 receives the request and displays it to the controller.	
			FDPS2 automatically sends the CPDLC message STANDBY.	CPDLC message element 1 .
	The avionics receives the STANDBY message and displays it to the aircrew.			FDPS2 determines whether it is possible for the aircraft to receive the requested climb. It is assumed that the request is conflict free and the aircraft can climb immediately to FL390.
			FDPS2 constructs the following CPDLC message CLIMB TO AND MAINTAIN FL390 and passes it to the controller.	CPDLC message element 20
			The controller authorises FDPS2 to send the message to the aircraft.	The FDPS2 database is updated once the clearance has been authorised by the controller.
	The avionics receive the CPDLC message and display it to the aircrew. The aircrew send the CPDLC message WILCO.			
			FDPS2 receives the WILCO message and displays it to the controller.	

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
	The aircrew enter the new clearance into the FMS.			
Time: 10:29:48	The aircraft starts to climb.			It is assumed that the aircraft climbs at 1000ft per minute.
Time: 10:30:00 Aircraft at FL332	The ADS application detects that the aircraft has climbed 200 ft above its cleared level and issues a ADS Level Range Deviation (LRD) event report. This provides the Basic Group (including the altitude). The LRD event report is generated once every minute whilst the aircraft is ±200 ft from flight level stored in the airborne ADS application.			The ADS Standard Agreement included an event contract for the detection of a Level Range Deviation (LRD) of ±200 ft from the flight level stored in the airborne ADS application. The receipt of the periodic LRD event reports will be used to update the FDPS2 database as each report will contain in the Basic Group the aircraft's altitude.
Time: 10:30:10		The LRD event report is received by FDPS2.	If required, FDPS2 constructs the CPDLC message LEAVING FL330 from receipt of the LRD event report and displays it to the controller (if necessary).	As the aircraft had been instructed to climb, this LRD event report was expected by FDPS2, which then constructs the CPDLC message from the expected receipt of the ADS LRD. It is assumed that it takes 10 seconds for the message to reach FDPS2.
Time: 10:31:00 Aircraft at FL342	A LRD event report is generated.			
		The LRD event report is received by FDPS2.		The FDPS2 database is updated with the aircraft flight level of FL342.
Time: 10:32:00 Aircraft at FL352	A LRD event report is generated.			

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Time: 10:32:10		The LRD event report is received by FDPS2.	FDPS2 constructs and displays to the controller the CPDLC message PASSING FL350 (if necessary).	The FDPS2 database is updated with the aircraft flight level of FL352.
Time: 10:33:00	A LRD event report is generated.			
Aircraft at FL362				
Time: 10:33:10		The LRD event report is received by FDPS2.		The FDPS2 database is updated with the aircraft flight level of FL362.
Time: 10:34:00	A LRD event report is generated.			
Aircraft at FL372				
Time: 10:34:10		The LRD event report is received by FDPS2.	FDPS2 constructs and displays to the controller the CPDLC message PASSING FL370 (if necessary).	The FDPS2 database is updated with the aircraft flight level of FL372.
Time: 10:35:00	A LRD event report is generated.			
Aircraft at FL382				
Time: 10:35:10		The LRD event report is received by FDPS2.		The FDPS2 database is updated with the aircraft flight level of FL382.
Time: 10:35:48				The aircraft reaches the cleared flight level of FL390.
Aircraft at FL390				
Time: 10:36:00	A LRD event report is generated.			
Time: 10:36:10		The LRD event report is received by FDPS2.	FDPS2 constructs and displays to the controller the CPDLC message REACHING FL390 (if necessary).	The FDPS2 database is updated with the aircraft flight level of FL390.
Time: 10:36:20		FDPS2 amends the LRD event contract to FL390 with a ±200 ft threshold.		It is assumed that it takes 10 seconds for the ADS message to reach the avionics.
	Avionics reverts to ADS Standard Agreement.			

Scenario 4/2: Request for a Climb - CPDLC used to convey reports/confirmations.

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
Aircraft on organised track in the Shanwick FIR at FL330.				
	The aircrew construct and send the following CPDLC message REQUEST CLIMB TO FL390.			CPDLC message element 9. Shanwick is the CDA
			FDPS2 receives the request and displays it to the controller.	
			FDPS2 automatically sends the CPDLC message STANDBY to the aircraft.	CPDLC message element 0.
	The avionics receives the STANDBY message and displays it to the aircrew.			FDPS2 determines whether it is possible for the aircraft to receive the requested climb. It is assumed that the request is conflict free and the aircraft can climb immediately to FL390.
			FDPS2 constructs the following CPDLC message CLIMB TO AND MAINTAIN FL390 REPORT LEAVING FL330 REPORT REACHING FL390 and passes it to the controller.	CPDLC message elements 20, 128 and 175.
			The controller authorises FDPS2 to send the message to the aircraft.	The FDPS2 database is updated once the clearance has been authorised by the controller.
	The avionics receive the CPDLC message and display it to the aircrew.			
	The aircrew send the CPDLC message WILCO.			CPDLC message 0

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
			FDPS2 receives the WILCO message and displays it to the controller.	
	The aircrew enter the new clearance into the FMS.	FDPS2 disables the ADS LRD event contract upon receipt of the CPDLC message WILCO.		This is to stop false alarms being generated.
Time: 10:30:00	The aircraft starts to climb.			It is assumed that the aircraft climbs at 1000 ft per minute.
Time: 10:30:00	The aircrew send the CPDLC message LEAVING FL330.			
Time: 10:30:10			FDPS2 receives the message and displays it to the controller.	FDPS2 database updated. It is assumed that it takes the message 10 seconds to reach FDPS2.
Time: 10:30:20			The controller generates and sends the CPDLC message ROGER.	CPDLC message element 3
Time: 10:36:00 Aircraft at FL390	The aircrew construct and send the CPDLC message REACHING FL390.			
Time: 10:36:10		Upon receipt of the CPDLC message REACHING FL390, FDPS2 amends the LRD event contract to FL390 with a ±200 ft threshold.	FDPS2 receives the message and displays it to the controller.	FDPS2 database is updated with new aircraft level.
Time: 10:36:20	The new ADS LRD event contract is established.		The controller constructs and sends the CPDLC message ROGER.	
Time: 10:36:30	The avionics receives the CPDLC message and displays it to the aircrew.			

Scenario 5: Aircraft Emergency

Time or Aircraft Position	Action of Aircrew & Avionics	Ground Based Flight Data Processing Facilities		Notes
		ADS Application	CPDLC Application	
The aircraft is within the Shanwick FIR when it suffers and engine loss.				
	The aircrew issue an ADS Emergency Report message. The avionics automatically increase the reporting rate to once every 64 seconds.			
		FDPS2 receives the Emergency Report and displays it to the controller.		
	Aircrew use DCPC system to call Shanwick OACC to inform the controller of the situation and advise intended actions.			DCPC: Direct Controller Pilot Communications.
		.	FDPS2 automatically determines which aircraft are within 60 nm and +/- 2000 ft of the aircraft in emergency, constructs the appropriate message to advise these aircraft of the situation and sends it to the controller.	
			The controller amends the message if necessary and authorises FDPS2 to send it.	All aircraft in or entering the 60nm/4000ft volume surrounding the aircraft in emergency are automatically sent the alerting message and their ADS reporting rates are increased to the standard 64 second reporting rate until the aircraft leaves the Shanwick FIR.

Annex A: ATC Communications Management

Annex A/1 ATC Communications Management with Transferring ATSU and Receiving ATSU Data Link Equipped.

Source: Eurocontrol document Operational Requirements for Air/Ground Data Communications Services, Edition 0.c.

The following process describes the ATC Communications Management when both the Transferring ATSU (T-ATSU) and the Receiving ATSU (R-ATSU) are equipped for CPDLC operations. The terms 'manually' and 'automatically' are defined as follows:

manually an event resulting from a manual action by the controller or aircrew.

automatically an event identified by the system without any manual action by the controller or aircrew.

1a The T-ATSU automatically notifies the aircraft who the R-ATSU shall be and authorises it to establish a CPDLC NDA link.

1b The aircraft automatically requests the establishment of a CPDLC link with the R-ATSU (via a 'CPDLC-start req' message).

1c The R-ATSU automatically confirms the link establishment (via a 'CPDLC-start cnf' message).

2 The T-ATSU controller instructs the aircraft to monitor or contact the R-ATSU on its voice channel, using either voice or data. If voice is used, the T-ATSU provides the R-ATSU identification and voice channel to the aircrew, and instructs the aircrew to contact or monitor the R-ATSU. If the controller used data link to instruct the voice channel change, the data link instruction to monitor or contact the R-ATSU on its voice channel (VCI) is trigged.

If the controller instructed the communications transfer via voice:

3a The aircrew acknowledges the instruction by voice readback.

3b The T-ATSU controller manually triggers a CPDLC end request (CPDLC end req) to indicate that all further CPDLC exchanges will be with the R-ATSU.

3c The aircraft automatically terminates the CPDLC link with the T-ATSU, informs the T-ATSU of the termination of the link and enables its R-ATSU CPDLC link.

If the controller instructed the communications transfer via data link (VCI):

3a The aircrew manually acknowledge the instruction to transfer voice and CPDLC communications to the R-ATSU (PAM).

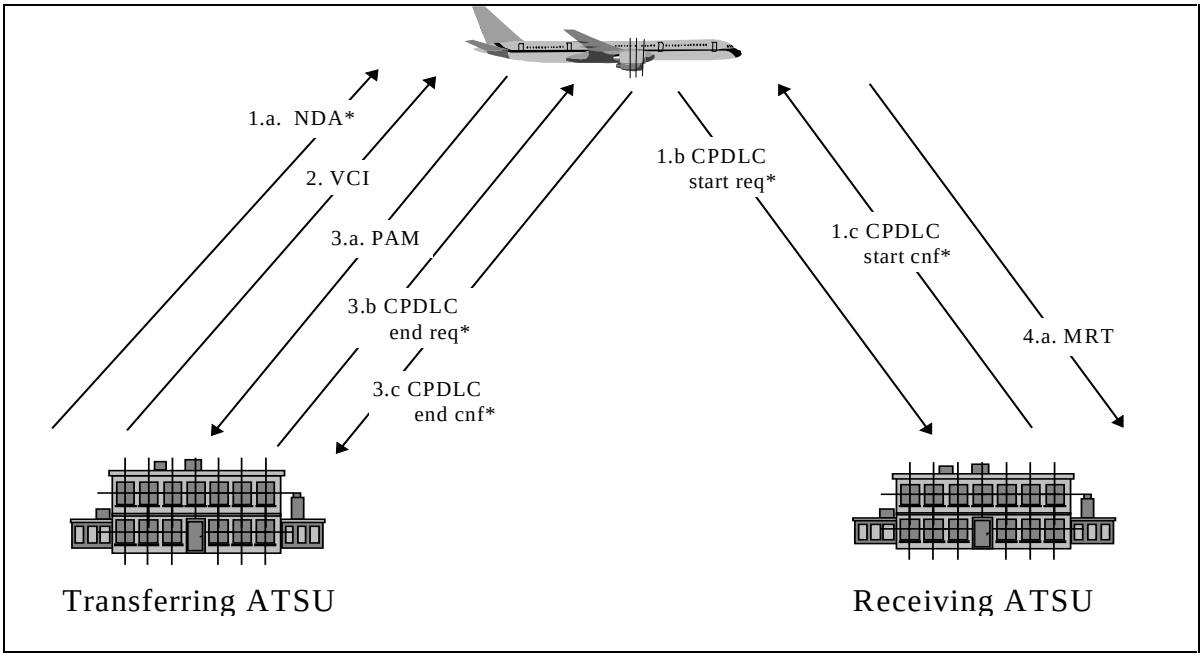
3b The T-ATSU automatically sends a CPDLC link end request (CPDLC end req) to the aircraft.

3c The aircraft automatically terminates the CPDLC link with the T-ATSU, informs the T-ATSU of the termination of the link (CPDLC end cnf) and enables its R-ATSU CPDLC link.

4a The aircrew manually activates the new voice channel and triggers a CPDLC 'Monitoring R/T' exchange to the R-ATSU (MRT).

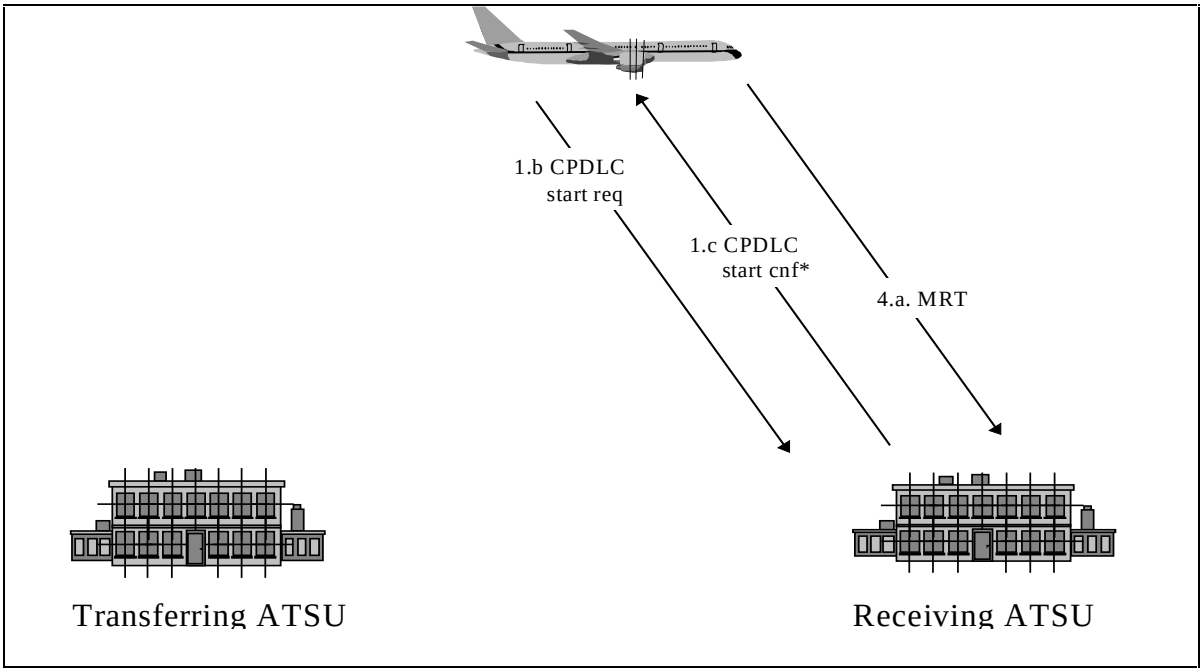
4b The aircrew contacts the R-ATSU on its voice channel when required. The R-ATSU controller acknowledges the aircrew's voice contact (if required).

In the following Information Exchange Diagrams, messages generated automatically are marked with the * symbol.


1.a. NDA*
2. VCI
3.a. PAM
3.b CPDLC
end req*
3.c CPDLC
end cnf*
1.b CPDLC
start req*
1.c CPDLC
start cnf*
4.a. MRT
Transferring ATSU
Receiving ATSU

Annex A/2 Transfer of Communications with Receiving ATSU Only Data Link Equipped

The process is as Annex A/1 but with the transferring ATSU substituting the data communications exchanges with voice exchanges.



Annex A/3 Transfer of Communications with Transferring ATSU Only Data Link Equipped

The process is as Annex A/1 but with the receiving ATSU substituting the data communications exchanges with voice exchanges.