International Civil Aviation Organization
North American, Central American and Caribbean Office

INFORMATION PAPER

ANI/WG/2 — IP/16
28/05/15

Second NAM/CAR Air Navigation Implementation Working Group Meeting (ANI/WG/2)
Puntarenas, Costa Rica, 1 to 4 June 2015

Agenda Item 4: **Follow-up on the NAM/CAR Regional Performance Based Air Navigation Implementation Plan (NAM/CAR RPBANIP)**
4.1 Progress reports of the Task Forces and the ANI/WG

OPERATIONAL USE OF CPDLC AND ADS-C IN TRINIDAD AND TOBAGO

(Presented by Trinidad and Tobago)

EXECUTIVE SUMMARY	
This paper serves to update the meeting of the work done in Trinidad and Tobago towards the implementation and operational use of CPDLC and ADS-C.	
Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Environmental Protection
References:	• Global Operational Data Link Document (GOLD) • ANI/AG/1 Conclusions

1. Introduction

1.1 Based on CONCLUSION ANI/WG/1/9 regarding the operational use of CPDLC and ADS-C in the CAR Region, Trinidad and Tobago conducted an analysis of the Piarco FIR and developed an implementation plan for the operational use of ADS-C and CPDLC.

1.2 The use of ADS-C and CPDLC would greatly enhance situational awareness and communication in the Oceanic Sector, thus increasing safety, improving efficiency and reduce harmful CO2 emissions.

2. CPDLC and ADS-C Implementation Update

2.1 In order to implement CPDLC and ADS-C in the Piarco FIR (TTZP), a cross functional team from the TTCAA Air Navigation Services was convened. The task force comprised Planning and Development Officers, ATS Unit Chiefs, CNS personnel and AIM personnel. The task force devised a work schedule to chart the activities to be undertaken in this project (**APPENDIX A**).

2.2 The testing phase of the CPDLC/ADS-C capability of the ATM system began on May 20, 2015. This was the first phase in a series of tests planned to be conducted to achieve full implementation. The intention is to conduct a series of tests over a two month period followed by operational trials for one month. Two months of training would be required to give all operational ATCOs the required exposure in the live environment, while CPDLC would form a module for transitional training of new ATCOs. It is anticipated that by December 2015 full CPDLC/ADS-C implementation would be achieved.

2.3 A series of comprehensive tests in the ATM simulator were carried out, where all the available messages and scenarios were tested off-line preceded the live testing. Information was collected on the response of pseudo aircraft to the different clearances and instruction to build an understanding of what could be expected in the real environment.

2.4 Phase one tests were conducted in the continental sector of the TTZP FIR where VHF voice communication is available. This sector was chosen since this was the first use of the ATM system for this mode of communication (see NOTAM 1, **APPENDIX B**). The outcome of these tests would verify the connectivity in the first instance and reliability of connection as aircraft traverse the airspace.

2.5 From the observations made at this first phase of tests enquiries about the range of datalink coverage as depicted on the General Radar Picture (GRP), VDL range in the sector and any automatic features that may be available such as message notification were made. The HMI was also closely monitored to assess the suitability of CPDLC as a means of communication in a sector where SSR is provided.

2.6 The second phase of tests is scheduled from May 27, 2015 and this would be conducted in the Oceanic Sector of the "TTZP". Voice communication, via a third party, would continue to be the primary means of clearance delivery and position reporting during these tests. A planned third phase of testing would use all of the recommended messages for aircraft in the Oceanic Sector (see NOTAM 2, APPENDIX B). This is in keeping with the CONOPS agreed on by the task force.

2.7 Following the test phases, the operational trials would begin with limited hours of service daily. This exercise would increase the level of comfort with which ATCOs use the ATM system, allow opinions to be formed on particular customizations that may be required and identify hazards inherent in the use of the ATM system for CPDLC.

2.8 The training of operational ATCOs would consist of a class room session, simulator exercises and training in the live environment under the watch of an on –the –job training instructor (OJTI). The OJTI would receive classroom, simulator and practical training and be certified by an air traffic examiner (ATE) as competent in using CPDLC as a communication medium. This has been deemed appropriate by the TTCAA regulator.

3. Service Monitoring

3.1 Because of integrated nature of the system and degree of inter-related components including physical systems, human elements and procedures, end –to-end monitoring would be conducted. The attached table (**APPENDIX C**) defines the set values to be met and verified. The data communications service provider has been asked to provide statistical data on performance, availability, reliability and integrity. Whereas the intention is ensure an efficient operation, the monitoring of performance would also serve as an indicator of diminishing performance. Performance problems can be identified and detailed investigation into trends will allow action to be taken before performance becomes unacceptable.

3.2 A fault reporting form has been created for the collection of FANS fault. This form would be made available to operators and the service provider in electronic form. These reports gathered would be analysed by a central reporting agency and contribute to the overall service monitoring report (**APPENDIX D**).

4. System Safety Assessment

4.1 An initial safety assessment was conducted based on an SMS type evaluation of risk mitigation. As tests and trials continue hazards not initially considered may become more apparent and these shall be included in the safety assessment. It is expected that at the end of training a comprehensive account of possible hazards would be had and appropriate mitigations devised.

5. Automation and customization

5.1 The End Service and CPDLC Connection Transfer Up-link messages may be automated in the ATM system to ensure that aircraft connect to the non-active data connection on exiting the TTZP FIR. It would be pursued with the ATM supplier as a customized feature.

5.2 Transfer of communication message may be another custom feature to be addressed the timing of which would be determined by bilateral coordination. The respective letters of agreement would reflect the agreed position.

5.3 As the ATM testing and operational trials continue it is expected that further customization would be requested. A comprehensive list of such request would be compiled at the end of trials and submitted for consideration to the management of the TTCAA Air Navigation Services Management.

6. Regulatory Activities

6.1 The process as outlined above was presented to the TTCAA Regulator for ATS and was approved. The training material, operations procedures and CONOPS formed part of the presentation delivered to the regulatory authority.

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EXTRACT OF FANS 1/A IMPLEMENTATION WORK PROGRAMME

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
0		FANS 1/A	168 days?	Wed 14-01-1	Thu 17-09-15		
1		1 Decide on the Opeational Concept(CONOPS)	5 days	Mon	Fri 23-01-15		
2		1.1 Decide on the scope and extent of CPDLC	5 days	Mon	Fri 23-01-15		MAPD,MATS,UC
3		1.1.1 decide if CPDLC would become	1 day	Fri 23-01-15	Fri 23-01-15		MAPD,MATS,UC
4		1.1.2 Discuss retaining HF/VHF as a	1 day	Fri 23-01-15	Fri 23-01-15		MAPD,MATS,UC
5		2 Change IDENTIFIER TO TTZP	107 days	Fri 13-02-15	Thu 23-07-15		
6		2.1 Write ARINC to have change actioned	66 days	Mon	Thu 23-07-15		MAPD,MCNS
7		2.2 Change LOG-ON address in the SELEX ATM	65 days	Mon	Wed		MAPD,MCNS,SELEX
8		2.3 Publish Change on Chart, AIP, Doc7030	100 days	Fri 13-02-15	Tue 14-07-15		MAIM,MAPD
9		3 Perform safety assessment of CONOPS	90 days	Mon	Thu 17-09-15		
10		3.1 Perform SMS Type Analysis of risks	85 days	Mon	Thu 10-09-15		UC ASU,UC P&TEU
11		3.2 Write a safety case for the CPDLC based	5 days	Fri 11-09-15	Thu 17-09-15	10	UC ASU,UC P&TEU
12		4 NOTIFY TTCAA REGULATOR OF THE	15 days	Mon	Tue 07-07-15		
13		4.1 Obtain approval from CAA Regulator for	15 days	Mon	Tue 07-07-15		MAPD,SAFETY
14		5 SITE VISIT TO AN ANSP	5 days	Mon	Fri 27-03-15		
15		5.1 A site visit to observe CPDLC service and	5 days	Mon	Fri 27-03-15		MAPD,MATS,UC
16		6 NON_OPERATIONAL TESTING	11 days?	Wed	Wed		
17		6.1 compile a list of available messages from a	1 day?	Wed	Wed		UC P&TEU
18		6.2 use simulator to exchange messages	5 days	Thu 22-01-15	Wed		UC ATU,UC
19		7 OPERATIONAL TESTING	168 days?	Wed	Thu 17-09-15		
20		7.1 Determine and develop operational test	5 days	Mon	Fri 30-01-15		UC ASU,UC
21		7.2 establish a reporting address to collect ads	1 day?	Wed	Wed		
22		7.3 Acquire ATCOs to be part of the	5 days?	Mon	Fri 06-02-15		MATS,UC ATU,UC
23		7.4 Liaise with selected operators to conduct	20 days	Mon	Tue 03-03-15	18	EMANS,MAPD,UC

Project: FANS 1/A
Date: Tue 26-05-15

Task	Inactive Summary	External Tasks			
Split	Manual Task	External Milestone			
Milestone	Duration-only	Deadline			
Summary	Manual Summary Rollup	Progress			
Project Summary	Manual Summary	Manual Progress			
Inactive Task	Start-only				
Inactive Milestone	Finish-only				

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APPENDIX B
NOTAM 1 AND 2

NOTAM 1: PHASE ONE TESTING

A0543/15A03 NOTAMN
Q) TTZP/QCATT///AE/000/999/1450N05112W801
A) TTZP B) 1505201500 C) 1505222200
D) DAILY 1500 - 2200
E) THE TRINIDAD AND TOBAGO CIVIL AVIATION AUTHORITY (TTCAA) ANSP HAS BEGUN THE PROCESS OF IMPLEMENTING FANS 1/A SERVICE (ADS-C AND CPDLC) WITHIN THE PIARCO FLIGHT INFORMATION REGION. A PERIOD OF ATM SYSTEM TESTS AND OPERATIONAL TRIALS WILL PRECEDE INITIAL IMPLEMENTATION.
ATM SYSTEM TESTS WILL BE CONDUCTED FROM MAY 20 -22, 2015 BETWEEN THE HOURS OF 1500Z AND 2200Z.
INITIAL ATM SYSTEM TESTS SHALL BE CONDUCTED WITHIN PORTIONS OF THE PIARCO FIR WHERE THERE IS DIRECT CONTROLLER PILOT VOICE COMMUNICATION.
DURING THE ATM SYSTEM TESTS, DIRECT CONTROLLER PILOT VOICE COMMUNICATION SHALL REMAIN THE SOLE MEANS OF OPERATIONAL ATS COMMUNICATION BETWEEN ATC AND PILOTS. THE USE OF CPDLC AND ADS-C SHALL BE SOLELY FOR THE PURPOSE OF TESTING EQUIPMENT.
THE ASSISTANCE OF ALL SUITABLY EQUIPPED AIRCRAFT WITH FANS QUALIFIED CREWS DURING THESE TRAILS WILL BE APPRECIATED AND ACCOMMODATED AS FAR AS PRACTICABLE.(END PART 1 OF 3)

(A0543/15B03 NOTAMN
Q) TTZP/QCATT///AE/000/999/1450N05112W801
A) TTZP B) 1505201500 C) 1505222200
D) DAILY 1500 - 2200
E)FLIGHT PLANNING
AIRLINE OPERATORS SHALL FILE THE REQUIRED EQUIPMENT DATA IN THE FOLLOWING FIELDS:
-FIELD (10A) CPDLC (J1-J7)
-FIELD (10B) ADS-C (D1)
-FIELD (18) AIRCRAFT REGISTRATION REG/XXXXX
-FIELD (18) AIRCRAFT 24 BIT ADDRESS CODE/XXXXXX
END PART 2 OF 3)

(A0543/15C03 NOTAMN
Q) TTZP/QCATT///AE/000/999/1450N05112W801
A) TTZP B) 1505201500 C) 1505222200
D) DAILY 1500 - 2200
E)THE FOLLOWING PROCEDURES FOR TWO WAY COMMUNICATIONS WILL APPLY DURING
THE TESTING PERIOD:
-WHEN UNDER THE CONTROL AND IN COMMUNICATION WITH PIARCO ACC, PILOTS WILL BE INSTRUCTED VIA VOICE COMMUNICATION TO LOG ON TO TTZP
-PIARCO ACC WILL ADVISE OF SUCCESSFUL LOGON VIA VOICE: (CALLSIGN) CPDLC AND/OR ADS CONTACT ESTABLISHED.
-PIARCO ACC WILL ADVISE IT IS SENDING FREE TEXT MESSAGE VIA VOICE (CALLSIGN) PIARCO TRANSMITTING CPDLC TEST
-PIARCO ACC SHALL TRANSMIT FREE TEXT MESSAGE VIA CPDLC : CPDLC TEST
-PILOT SHALL ACKNOWLEDGE RECEIPT, FIRST VIA VOICE RECEIVED TEST

(CALLSIGN)
-PILOT SHALL THEN ACKNOWLEDGE BY SENDING RETURN FREE TEXT MESSAGE
TEST RECEIVED
FOR ANY FURTHER INFORMATION OR CLARIFICATION REQUIRED, PLEASE
CONTACT:
PIARCO ACC AT TTZPZQZX OR
MANAGER ANS PLANNING DEVELOPMENT
TELEPHONE 868 669 4806
EMAIL RMOHAMMED AT CAA.GOV.TT
END PART 3 OF 3)

NOTAM 2: PHASE TWO TESTING

A0636/15A02 NOTAMN
Q) TTZP/QCAXX/IV/NBO/AE/000/999/1450N05112W801
A) TTZP B) 1505271600 C) 1505292000
D) DAILY 1600 - 2000 UTC
E) THE TRINIDAD AND TOBAGO CIVIL AVIATION AUTHORITY (TTCAA) IS IN THE
PROCESS OF IMPLEMNTING ADS-C AND CPDLC WITHIN THE PIARCO FIR. TO
ACHIEVE THIS IT IS A REQUIREMENT TO CONDUCT TRIALS ON OUR AIR TRAFFIC
MANAGEMENT (ATM) SYSTEM.
VOICE COMMUNICATIONS SHALL REMAIN THE PRIMARY MEANS OF CLEARANCE
DELIVERY AND POSITION REPORTING.
AIRLINE OPERATORS SHALL FILE THE REQUIRED EQUIPMENT DATA AND
INFORMATION IN THE FOLLOWING FEILDS:
-FIELD (10A) - CPDLC (J1-J7)
-FIELD (10B) - ADS-C (D1)
-FIELD (18) - AIRCRAFT REGISTRATION REG/XXXXX
-FIELD (18) - AIRCRAFT 24 BIT ADDRESS CODE/XXXXXX
THE FOLLOWING PROCEDURES FOR TWO WAY COMMUNICATIONS WILL APPLY
DURING THE TEST PERIOD:
-PILOTS ARE REQUESTED TO LOG-ON TO (TTZP) THIRTY (30) MINUTES PRIOR TO
CROSSING THE FIR.PIARCO ACC SHALL BE SELECTED AS THE CDA ON CROSSING
THE FIR BOUNDRY IF NOT DONE BY THE TRANSFERRING ATS UNIT.
-CPDLC CLEARANCES WOULD BE LIMITED:
       1)VERTICAL CLEARANCES FOR CLIMB AND DECENT
       2)ROUTE MODIFICATION TO PROCEED DIRECT A FILED POSITION ON THE
FLIGHT PLAN
       3)DEVIATION REQUESTS
-SURVEILLANCE REQUEST
       1)SQUAWK CODE
-FREE TEXT MESSAGES
END PART 1 OF 2)

(A0636/15B02 NOTAMN
Q) TTZP/QCAXX/IV/NBO/AE/000/999/1450N05112W801
A) TTZP B) 1505271600 C) 1505292000
D) DAILY 1600 - 2000 UTC
E) AIRCRAFT AT OR EAST OF 57W SHOULD MAKE REQUESTS FOR ALTITUDE AND ROUTE CHANGES VIA CPDLC. A FREE TEXT MESSAGE FROM ATC SHALL BE SENT TO ACKNOWLEDGE THESE REQUESTS. ATC CLEARANCE SHALL BE VIA VHF/HF VOICE ONLY. AIRCRAFT WEST OF 57W SHOULD USE VHF VOICE AS PRIMARY MEANS OF COMMUNICATION.
THE FOLLOWING SEQUENCE SHALL BE FOLLOWED:
- WHEN WITHIN THE PIARCO FIR EAST OF 57W REQUESTS FOR VERTICAL CLEARANCES, ROUTE MODIFICATION OR DEVIATION REQUEST SHOULD BE MADE VIA CPDLC.
- PIARCO WILL TRANSMIT AN UP-LINK ((TYPE OF REQUEST) REQUEST RECEIVED,MONITOR VOICE)
-CLEARANCE WOULD BE TRANSMITTED VIA VOICE.
-FLIGHT WOULD PROVIDE READ BACK VIA VOICE TO THE RECEIVED CLEARANCE.
PARTICIPATING FLIGHTS ARE REQUIRED TO MONITOR THE ASSIGNED VHF/HF. IF NO CPDLC RESPONSE IS RECEIVED FROM ATC WITHIN FIVE(5) MINUTES THEN VOICE CONTACT SHOULD BE MADE. ANY FURTHER INFORMATION REQUIRED, PLEASE CONTACT:
PIARCO ACC AT TTZPZQZX OR
MANAGER ANS PLANNING AND DEVELOPMENT TEL: 868 669 4806
EMAIL:RMOHAMMED(AT)CAA.GOV.TT
END PART 2 OF 2)

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APPENDIX C

CRITERIA	DEFINITION	VALUES
Performance	End-to-end round trip time (RTT) for uplinks per delivery media (VDL,SATCOM or HFDL. The timing would be measured from sending of the uplink until receipt of the MAS	RTT of 120 seconds, 95% of messages. RTT of 360 seconds 99% of messages
	End-to-end round trip time (RTT) for uplinks per delivery media (VDL,SATCOM or HFDL. The timing would be measured from the message sending time stamp and massage receipt time stamp	One way time of 60 seconds, 95% of the message. One way time of 360 seconds, 99% of the messages
	Uplink messages only: Undelivered messages will be determined by: • Message assurance failure is received. After trying both VHF and SATCOM. Depending on reason code received, the message might, in fact, have made it to the aircraft. • No message assurance or flight crew response is received by ATSU after 900 seconds	Less than 1% of all attempted messages undelivered
Availability	The ability of the network data link service to perform a required function under given conditions at a given time: The maximum allowed time of continuous unavailability or downtime should be declared (MTTR) *	99.9% TBD
Reliability	The ability of a data link application/system to perform a required function under given conditions for a given time interval: it can be expressed in MTBF (Mean Time Between Failure) *	TBD
Integrity	The probability of an undetected failure, event or occurrence within a given time interval.	10^{-6}/hour

Availability = MTBF x 100/(MTBF+MTTR)

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APPENDIX D
FAULT NOTIFICATION FORM

ANSP
Air Navigation
Service Provider

FANS Fault Notification Form

1. Reporting Date	**2. Reporting Unit**		
3. Call sign	**4. Aircraft Type**	**5. Registration**	**6. Fans Equipment**
7. Date of Occurrence	**8. Time of Occurrence (UTC)**	**9. Occurrence Position in FIR**	
10. Description and Action Followed:			
11. Crew/Controller Comments (If Any):			

Classification:

1. Log-on received form aircraft not in your FIR
2. Aircraft Log-on with incorrect flight identification
3. Log-on from aircraft not declaring ADS capability in Flight Plan
4. Unknown ADS message received
5. Aircraft remain ADS connected after exiting airspace
6. Aircraft remain ADS connected after landing
7. Different reports in the same ADS message
8. Identical reports of Waypoint Change received in an ADS message
9. CPDLC Message: 'Noet Current Data Authority"
10. Incorrect downlink CPDLC message have been received
11. Other (describe):_____

(adapted from : ICAO EUR/SAM Corridor)

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