Sixteenth Meeting of the Cross Polar Trans East Air Traffic Management Providers' Work Group (CPWG/16)

(Ottawa, Canada 3-6 December 2013)

Agenda Item 5: Provide Status on CPWG/15 Actions

STATUS UPDATE FOR DEVELOPMENT AND IMPLEMENTATION OF ADS-C CLIMB DESCENT PROCEDURE

(Action Item #CP14-12)

(Presented by the Federal Aviation Administration)

SUMMARY

This paper presents the U.S. Federal Aviation Administration (FAA) activities associated with the ADS-C Climb/Descend Procedure (CDP) operational trial conducted in the Pacific.

1. Introduction

1.1 The Automatic Dependent Surveillance – Contract (ADS-C) Climb/Descend Procedure (CDP) is designed to improve service to properly equipped aircraft by allowing an oceanic air traffic controller to have an option for granting an altitude change request when other standard separations, such as ADS-C distance-based 30 nautical mile (NM) longitudinal separation minima, do not allow for a climb or descent through the altitude of a blocking aircraft. It is an air traffic control tool to be applied between maneuvering and blocking aircraft pairs.

1.2 The United States (U.S.) Federal Aviation Administration (FAA) developed the ADS-C CDP to utilize existing user equipage and air traffic control (ATC) capabilities to allow more oceanic flights to achieve their preferred vertical profiles. The ADS-C CDP is a component of the FAA Oceanic Trajectory Based Operations (OTBO) program, a critical Next Generation Air Transportation System (NextGen) capability that addresses current performance gaps in the area of capacity, productivity, and efficiency in the oceanic environment. Integral to ADS-C CDP is the use of advanced communication, navigation, and surveillance (CNS) capabilities; e.g., ADS-C, Controller-Pilot Data Link Communications (CPDLC), and Required Navigation Performance (RNP).

1.3 This procedure is based on in-trail Distance Measuring Equipment (DME) rules in ICAO Doc 4444, paragraph 5.4.2.3.2. Aircraft pair distance verification is performed by the Advanced Technologies & Oceanic Procedures (ATOP) automation system, using near simultaneous ADS-C demand contract reports. As with the existing DME procedure, responsibility for separation assurance remains with ATC.

1.4 ADS-C CDP enables oceanic airspace users to benefit from the surveillance provided by ADS-C, and thus to more efficiently use airspace. Specifically, ADS-C surveillance enables climb-through and descend-through maneuvers with less than standard separation (up to 15 NM). As such, controllers can clear qualified aircraft to climb or descend through the altitude of what would otherwise

be a blocking aircraft. This ability to maneuver around blocking aircraft will allow aircraft to optimize flight levels over long distance flights, thus reducing fuel burn and emissions. This CDP supports the FAA's goals for fuel efficiency, emission reductions, and increasing air traffic capacity with existing equipment.

2. Discussion

2.1 To achieve early benefits, ADS-C CDP was demonstrated in operational trials by manually applying ADS-C CDP requirements without changes to the FAA ATOP automation system and was limited for use between RNP-4 qualified aircraft.

2.2 Figure 1 shows a basic depiction of the associated procedure. During execution of the procedure, the controller is responsible for ensuring separation with all aircraft at the blocking altitude and target CDP altitude by using the ATOP conflict probe decision support tool. Lateral, longitudinal and vertical separation minima for aircraft not eligible for ADS-C CDP will not change.

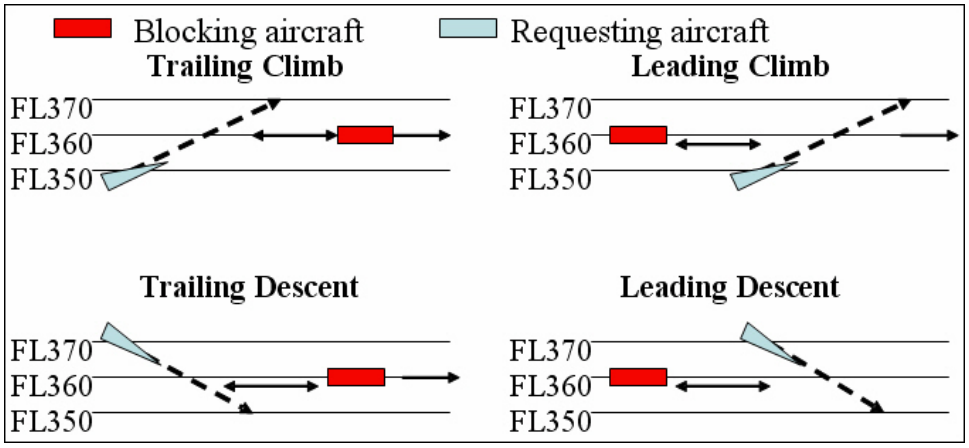


Figure 1: ADS-C CDP

2.3 Oakland Air Route Traffic Control Center (ARTCC) applied ADS-C CDP separation to appropriately equipped proximate pairs of aircraft throughout the Oakland Oceanic Control Area (CTA) during the operational trial. Aircraft equipment requirements are as follows:

a) Maneuvering and blocking aircraft are qualified and approved for RNP-4; and,

b) Maneuvering and blocking aircraft have active FANS-1/A ADS-C and CPDLC connections.

2.4 Operational trials for the use of the ADS-C CDP began on 15 February 2011 in the Oakland Oceanic CTA and ended 15 February 2013.

2.5 During the two-year timeframe of the trials, the ADS-C CDP was successfully utilized eight times.

2.6 Due to the inherent limitations of the manual execution of the procedure, there are no plans to extend the manual trial (Attachment A - Controller Checklist). Alternatively, fast-time simulations are currently being conducted at the FAA William J. Hughes Technical Center (WJHTC).

These simulations will model the use of the ADS-C CDP in a more densely populated environment, thereby increasing the opportunity for use and further validating the procedure.

3. ADS-C CDP Air Traffic Control Automation Requirements

3.1 Implementation of the ADS-C CDP automation will benefit ADS-C equipped aircraft; non-equipped aircraft will continue to receive the current level of service. From the controllers' perspective, the implementation of the ADS-C CDP system will cause no change in workload, as all the separation calculations are performed internally. From a systems efficiency perspective, the proposed ADS-C CDP system will allow for increased efficiency and improved flow for properly equipped aircraft.

3.2 Use of ADS-C technology will lower controller work load by automating the routine task of issuing a climb or descent clearance. Automated procedure determination, clearances, and problem prediction and resolution will allow the controller to handle more aircraft because predicted problems will be resolved strategically, reducing the number of situations that demand multiple time-critical actions.

3.3 ADS-C CDP automation, when ready as an operational capability, will be installed and employed in New York, Oakland and Anchorage oceanic airspace. Initial deployment of the ADS-C CDP in the automated platform will be conducted as an operational trial in all three Oceanic FIR's where the FAA provides air traffic services.

3.4 Operational and functional requirements:

a) The ADS-C CDP system shall determine when reduced separation standards can be applied for climbing/descending aircraft by determining the eligibility of the request for CDP;

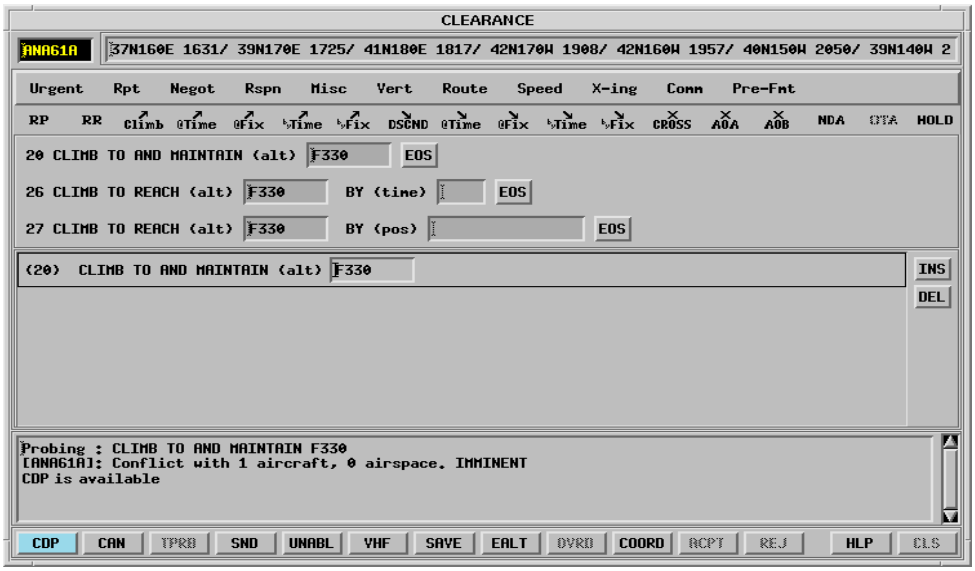
b) If the initial ATOP conflict probe indicates a conflict situation, the ADS-C CDP system shall account for the aircraft making the request (the maneuvering aircraft), the blocking aircraft, and all other traffic in determining the initial eligibility of the maneuver;

c) Following this determination, the system shall build and display the appropriate response for the controller (CLIMB TO [*flight level*] BY [*time*] or DESCEND TO [*flight level*] BY [*time*] message with ADS-C CDP or UNABLE);

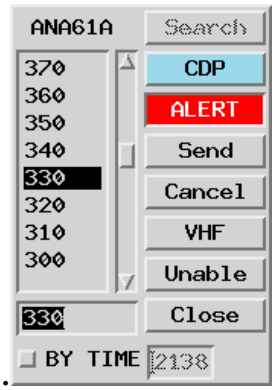
d) The controller shall either issue the clearance for the climb/descend or UNABLE. Thus, from the controller's standpoint, there will be minimal change in operations; and,

e) The ADS-C CDP system shall be able to handle multiple maneuvers in one or multiple sectors.

f) If ALL criteria are met, the PRB button in the clearance window, or the Probe button in the altitude popup window, will display CDP with a sky blue background as shown below:



or…



CDP enabled from probe initiated from request

Altitude popup window with BY time altitude clearance

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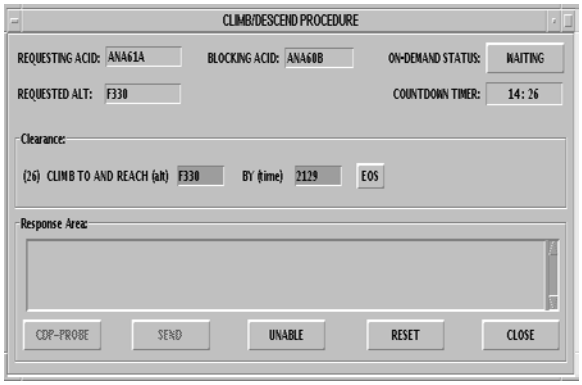
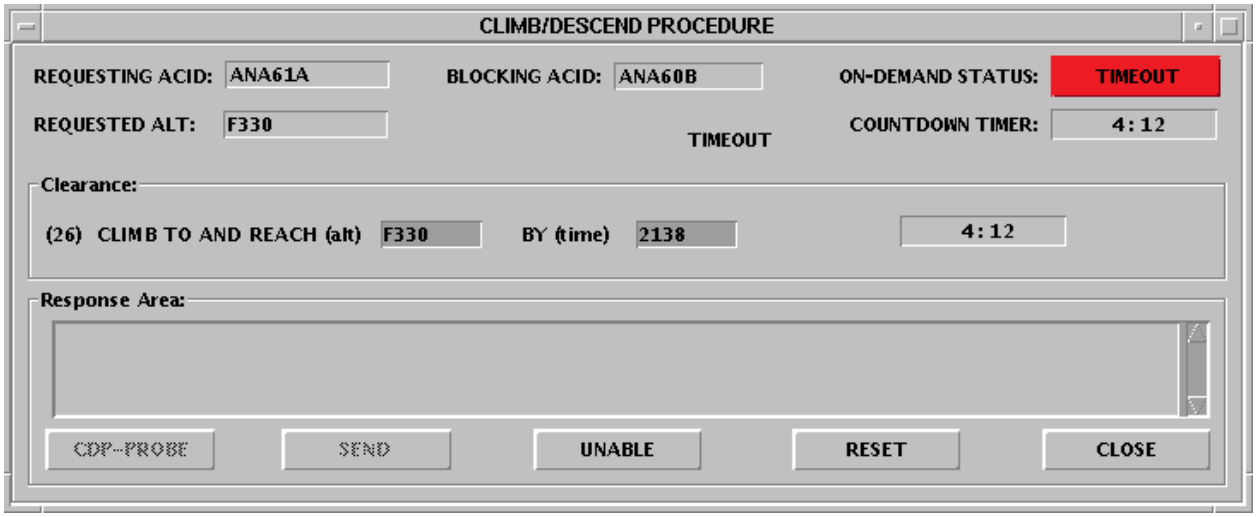


CDP window with BY time value



CDP window with on-demand timeout

4. ADS-C Trial to Implementation Schedule

4.1 The current working schedule is as follows:

ADS-C CDP Master Schedules - 7/9/13		
Milestones & Tasks	**Working Schedule**	**PLA**
ICAO Procedure Change	**12/31/2014**	**6/30/2015**
Repurpose analytical model with changes recommended by the Panel	-	
Develop simulation model to explore the interactions between principal random variables whose effects are confounded within sampled data	-	
Conduct data collections to describe variable distributions and parameter estimates	-	
Report analytical results to the Panel	-	
Obtain Panel concurrence or critical comments	-	
Describe operational limits for the application of the procedure	-	
Propose draft ICAO document or circular material to the Panel for its recommendation	-	
Initial Brief to ANC w/timeline	6/20/2013	
Hazard Panel	9/15/2013	
Draft Circular	10/15/2013	
SASP November 2013 Meeting - Report	10/31/2013	
ICAO Proposal for Amendment (PFA)		
Develop ICAO Proposal for Amendment and Impact Statement	10/15/2013	
ICAO Proposal for Amendment	3/31/2014	2/28/2015
Develop ICAO Proposal for Amendment	3/31/2014	12/31/2014
Deliver ICAO Proposal for Amendment	4/30/2014	2/28/2015
Deliver ICAO Proposal for Amendment and Impact Statement	5/1/2014	
SASP Work Backlog/schedule		
SASP May 2014 Meeting - Report/Final Approval	5/30/2014	
ADS-C CDP Automation Collision Risk Model	6/30/2014	7/31/2015
Conduct ADS-C CDP Automation Collision Risk Model Assessment	5/31/2014	6/30/2015
Deliver ADS-C CDP Automation Collision Risk Model	6/30/2014	7/31/2015
FAA Procedure Change		
Develop regional application material for the subject airspace	-	
Suggest on-going monitoring requirements (if any) to support SMS	-	
Prepare FAA implementation materials for application (SRMD and facility application limits)	-	
SRMD		
Site Test, Run, Report		
FAA Handbook 7110.65 procedure change	6/30/2014	6/30/2015
Develop documentation for the FAA Handbook procedure change	5/31/2014	5/31/2015
Receive approval for the FAA Handbook procedure change	12/31/2014	7/31/2015
Finalize Circular or other material		
Support the briefing of the procedure to the ANC		
Briefed to the ANC/ Procedure Approval	11/1/2016	

5. Action by the Meeting

5.1 The meeting is invited to note the information provided.

ATTACHMENT A- Controller ADS-C CDP Manual Checklist

ATC ADS-C CDP CHECKLIST

PRELIMINARY SCREENING CRITERIA CHECKS (STEPS 1-3)

Step #	Checklist Item	Checkmark or Insert Data
1.	AIRCRAFT CALLSIGNS.....	
2.	BOTH Blocking and Maneuvering Aircraft must have the "3" 30/30 ADS separation flag set.	
3.	a. Both Aircraft Level Flight/Aircraft 1,000 Feet Apart/Planned Altitude Change 2,000 Feet b. Neither Aircraft on WX Dev nor requesting a WX Dev. c. Both Aircraft RVSM d. "POS" NOT Displayed on Either Data Block e. There are no Out of Conformance (ARP) messages for either aircraft in the Sector Queue. f. Aircraft Same Direction traffic	

FINAL SCREENING CRITERIA CHECKS (STEPS 4-9)

4.	Initiate ADS DEMAND for both Aircraft. ENTER TIME that DEMAND request was sent to Maneuvering Aircraft	
5.	From ADD Report,	
	Mach Number of Maneuvering Aircraft.....	
	Mach Number of Blocking Aircraft.....	
6.	SAME SPEED OR FASTER AIRCRAFT IN FRONT: 6a, 6b, and 6c Must be Satisfied	
	6a. From Conflict Report Window, ACTUAL Longitudinal Distance Between Maneuvering and Blocking Aircraft AT LEAST 16 MILES	
	6b. From ASD, Both Aircraft Same Groundspeed, or Faster Aircraft is in Front	
	6c. From Step # 5, Both Aircraft Same Mach Number, or FASTER Mach AIRCRAFT IN FRONT	
7.	OVERTAKE SITUATION: 7a, 7b, and 7c Must be Satisfied	
	7a. From Conflict Report Window, ACTUAL Longitudinal Distance Between Maneuvering And Blocking Aircraft AT LEAST 26 MILES	
	7b. From ASD, Trailing Aircraft Groundspeed Must NOT be More Than 10 Knots Faster	
	7c. From Step # 5, Trailing Aircraft is NOT More Than .02 Mach Faster	
8.	Build Clearance utilizing MOPS Message 26 or 28, "CLIMB/DESCEND TO REACH (level) BY (time). Probe the Pending Clearance. Ensure that Time Inserted in Clearance is within 15 Minutes of Time Inserted in Step # 4.	
	8a. Append Free-Text Advisory from the Pre Formatted messages "ADS-C CDP PROCEDURE IS BEING APPLIED BY ATC".	
9.	Check the 2nd Profile Conflicts of the Maneuvering Aircraft. IF THERE ARE ACTUAL OR IMMINENT CONFLICTS WITH OTHER AIRCRAFT, DO NOT EXECUTE PROCEDURE	

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ATC ADS-C CDP CHECKLIST

PRELIMINARY SCREENING CRITERIA CHECKS (STEPS 1-3)

Step #	Checklist Item	Checkmark or Insert Data
1.	AIRCRAFT CALLSIGNS..... RCH3059 / RCH0315	✓
2.	BOTH Blocking and Maneuvering Aircraft must have the "3" 30/30 ADS separation flag set.	✓
3.	a. Both Aircraft Level Flight/Aircraft 1,000 Feet Apart/Planned Altitude Change 2,000 Feet or more. b. Neither Aircraft on WX Dev nor requesting a WX Dev. c. Both Aircraft RVSM d. "POS" NOT Displayed on Either Data Block e. There are no Out of Conformance (ARP) messages for either aircraft in the Sector Queue. f. Aircraft Same Direction traffic	✓

FINAL SCREENING CRITERIA CHECKS (STEPS 4-9)

Step #		
4.	Initiate ADS DEMAND for both Aircraft. ENTER TIME that DEMAND request was sent to Maneuvering Aircraft	1245Z 1240Z
5.	From ADD Report, Mach Number of Maneuvering Aircraft..... Mach Number of Blocking Aircraft.....	~~.80~~ .79 ~~.80~~ .81
6.	SAME SPEED OR FASTER AIRCRAFT IN FRONT: 6a, 6b, and 6c Must be Satisfied	
	6a. From Conflict Report Window, ACTUAL Longitudinal Distance Between Maneuvering and Blocking Aircraft AT LEAST 16 MILES	✓ 16
	6b. From ASD, Both Aircraft Same Groundspeed, or Faster Aircraft is in Front	✓ Faster in Front
	6c. From Step # 5, Both Aircraft Same Mach Number, or FASTER Mach AIRCRAFT IN FRONT	✓
7.	OVERTAKE SITUATION: 7a, 7b, and 7c Must be Satisfied	
	7a. From Conflict Report Window, ACTUAL Longitudinal Distance Between Maneuvering And Blocking Aircraft AT LEAST 26 MILES	
	7b. From ASD, Trailing Aircraft Groundspeed Must NOT be More Than 10 Knots Faster	
	7c. From Step # 5, Trailing Aircraft is NOT More Than .02 Mach Faster	
8.	Build Clearance Utilizing MOPS Message 26 or 28, "CLIMB/DESCEND TO REACH (level) BY (time). Probe the Pending Clearance. Ensure that Time Inserted in Clearance is within 15 Minutes of Time Inserted in Step # 4.	✓
	8a. Append Free-Text Advisory from the Pre Formatted messages "ADS-C CDP PROCEDURE IS BEING APPLIED BY ATC".	
9.	Check the 2nd Profile Conflicts of the Maneuvering Aircraft. IF THERE ARE ACTUAL OR IMMINENT CONFLICTS WITH OTHER AIRCRAFT, DO NOT EXECUTE PROCEDURE	✓