International Civil Aviation Organization

SECOND SATELLITE DATA LINK OPERATIONAL CONTINUITY MEETING TO REVIEW THE PERFORMANCE AND PROVISION OF SATELLITE COMMUNICATIONS IN THE ASIA AND PACIFIC REGIONS

(Bangkok, Thailand, 8-10 February 2012)

Agenda Item 2: **Review planning and implementation programs involving satellite communications (SATCOM) data-link services (Update since SOCM/1)**

2.1 State/ANSP planning and implementation of data-link services

i) Air traffic management (ATM) operational improvements

DATA LINK OPERATIONAL EXPERIENCE

(Presented by Federal Aviation Administration)

SUMMARY

This paper highlights some of the lessons learned by operational experience with data link operations.

1 INTRODUCTION

1.1 Oakland Air Route Traffic Control Center (ARTCC) has been using CPDLC since 1995. In 2005 Oakland began full time use of Automatic Dependent Surveillance (ADS) technology with the implementation of their Ocean21 ATC System. With the Ocean21 system, Oakland ARTCC began employing ADS-C Distance-based Separation Standards between aircraft.

1.2 There are many procedures in the GOLD and other ICAO Documents that must be applied when using data link. This paper highlights a few issues that ANSPs should consider when using data link.

2 DISCUSSION

2.1 As with any new technology, there are lessons to be learned regarding use of data link systems for air traffic control applications. Prior to initial use, procedures were established to maintain safety, should the satellite network fail. Over time, it was determined that other contingencies also needed to be addressed.

2.2 The first requirement is to have a secondary means of communication established and an orderly manner for transitioning to that mode if a data link network failure occurs. After initial implementation, it was discovered that many of aircrews, were not establishing HF radio contact with the Radio Communication Service Provider (RCSP) upon entering the Oakland Oceanic Control Area (OCA). When a network outage occurred, it took excessive time to establish HF communications with those aircraft. It took several initiatives in order to get the aircrews to maintain an HF listening watch. Always ensure that an alternate means of radio communications exists to contact flights in the event of a data link communications network failure.

2.3 Prior to using data link it was easy for controllers to deal with short-segment transfers where use of an information transfer would allow for an aircraft to transit a small distance of an adjacent facility's airspace and transfer the aircraft to the succeeding Air Navigation Service Provider (ANSP). There are several locations in the Oakland OCA where this traffic situation presents itself. With data link this can become a more complicated process. Most ATC systems have automated the data link transfer connection at the boundary. At a point or time before the aircraft is going to exit the FIR into another data link equipped facility, the system will automatically begin the data link transfer process to the next FIR. There are two issues to consider when an aircraft will transit a short segment in the next FIR:

a) If your FIR has the short segment transit and the data link connection will be transferred to your facility, difficulties can occur with an automated data link transfer. When the automated time comes for your system to transfer the data link connection to the next FIR, the NDA will be rejected by the aircraft if you are not the Current Data Authority (CDA). This happens because the aircraft is still in the first FIR. The data link connection must be transferred after the facility becomes the CDA, which may be difficult due to the short time in the FIR to make the change.

b) When controlling a flight that will transit a short route segment in another FIR, the controller must coordinate with the next FIR to determine if control of the aircraft will be transferred to that facility or to the second facility. If control of the aircraft is to be transferred directly to the second FIR, the controlling FIR must have procedures to skip the next FIR and transfer the data link connection to the second FIR. The short segment FIR which accepts an information transfer should be given an ADS-C connection so that they can monitor the aircraft's progress.

2.4 Another situation that presents itself near the boundary between ANSPs is attempting to answer clearance requests and not being able to ensure clearance delivery of the coordinated change prior to the aircraft switching to the next data authority. When near the boundary the CPDLC End of Service can be sent by the system, before the aircraft can be sent their clearance. When issuing clearances to an aircraft near an FIR boundary, determine if it is necessary to coordinate a delay in the transfer of the CPDLC connection with the receiving facility. The controller can then maintain the CPDLC connection with the aircraft until clearance delivery has been ensured.

2.5 When communicating with aircraft via voice, it is possible to cancel a clearance that was previously issued. Cancellation of a clearance sent via CPDLC is more difficult to accomplish. Once a clearance is sent to an aircraft it goes to a queue for the aircrew to respond to. Subsequent clearances go to the same queue to be processed. There is no way to ensure that a second clearance will be received ahead of another clearance. This results in ambiguity as to which clearance the pilot would actually follow. It was quickly learned that the fastest and safest way to handle such a situation is to revert to voice communication immediately to remove any ambiguity.

2.6 For aircraft able to be monitored through establishment of an ADS Contract (ADS-C), it was quickly learned that with this new surveillance ability, changes in course without permission were observed. The most common occurrences of this were aircrews initiating weather deviations without clearance. When utilizing the reduced separation techniques associated with ADS-C operations lateral deviations are critical safety concerns. To provide for immediate controller notification, Lateral Deviation Event (LDE) contracts are established with all ADS-C equipped aircraft. Additionally, pilots were educated regarding the ability to detect these deviations. The combination of these two processes has reduced the number of unauthorized weather deviations and reduced potential risks.

2.7 Periodic ADS-C and Waypoint Event contracts are established with aircraft in the Oakland Oceanic FIR. The frequency of the periodic reports varies depending on aircraft equipage. RNP10 equipped aircraft receive a 1600 second reporting rate and RNP4 equipped aircraft receive an 832 second reporting rate. At times a controller may have reason to question what an aircraft is doing in between periodic and waypoint event reports. Controllers have realized that an ADS-C demand report can quickly let controllers know where the aircraft is.

2.8 ADS-C position reports have greatly increased the accuracy of aircraft reporting and intent. The accuracy of ADS position reporting and the precise processing of messages by the air traffic control system create an environment where deviations from the route of flight results in "Out-Of-Conformance" (OOC) messages to controllers. ADS-C reports only contain latitude and longitude positions. This can make it more difficult for controllers to correlate the ADS-C report to waypoints. Even though it may take more effort, each of these OOC messages must be analyzed to determine whether action is necessary.

a) Controllers frequently encounter instances where aircrews insert an expected arrival routing into their FMS in expectation of being assigned a procedure. This creates extra controller workload because controllers receive OOC ADS-C reports which must be reconciled with the aircraft. A change has been proposed to the GOLD to prevent this from happening.

b) The most common cause of OOC ADS-C reports is the changing of FPL routes on an aircraft by the Airline Operations Center. We have seen numerous instances where an ATC facility does not get the change in routing. This is where careful reconciling of OOC ADS-C reports can prevent a difference between a flown route and the route that the controller is protecting.

2.9 One anomaly that occurs in an aircraft's FMS when a flight plan waypoint is passed by a lateral threshold away from waypoint. The lateral threshold is different for Airbus and Boeing aircraft. When the FMS passes a lateral distance from a waypoint, the aircraft does not record that it has passed the waypoint. The aircrew must take action to sequence the waypoint when they pass it in this case. If the waypoint is not sequenced, the ADS reports will have the aircraft's correct position, but the estimated point will be behind the aircraft. Although the aircraft continues on the correct course, the information presented to the controller indicates a reversal of course. In this case, the controller must advise the pilot to re-sequence their waypoints.

2.10 The FAA applies ADS-C distance-based separation standards to targets of opportunity. There have been significant improvements in the data link network since 2005 when Oakland ARTCC initially began operational use of ADS-C. To this date, the data link network has not demonstrated enough reliability for the FAA to consider restructuring Pacific ATS Routes and PACOTS tracks to operate with a 30NM ADS-C separation standard. Additionally, overall RNP4 aircraft equipage remains low in the Oakland and Anchorage Oceanic FIRs. ANSPs should consider the impact of an unplanned outage of the data link network while aircraft are en route before implementing route structures dependant on data link information. If multiple aircraft must be transitioned to different altitudes when data link connections are

lost, aircraft fuel burns could be significantly impacted and aircraft may not have enough fuel to make it to their destination.

3 ACTION BY THE MEETING

3.1 The Meeting is invited to note the information in this paper.

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