



*International Civil Aviation Organization*

**The Second Meeting of the Regional Airspace Safety Monitoring Advisory Group  
(RASMAG/2)**

Bangkok, Thailand, 4 – 10 October 2004

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**Agenda Item 5: Review regional and global airspace planning and implementation developments and provision of airspace safety monitoring services**

**REDUCTION OF WORKLOAD IN CPDLC OPERATION**

(Presented by JCAB CRA)

**SUMMARY**

This paper provides information on a review regarding the reduction of operational load in the CPDLC operation, when the ADS waypoint reports are applied to the primary means of surveillance and CPDLC position reports are no longer required.

**1. BACKGROUND**

1.1 Within the oceanic airspace out of VHF coverage in the Tokyo FIR, the CPDLC and ADS are the primary means of air/ground communication and surveillance for the FANS-1/A aircraft with CPDLC/ADS connections. Presently, in Tokyo FIR, position reports by HF voice are not required when they are managed by CPDLC, which mitigates the HF frequency congestion actually by almost 30 percent (almost 30 % of traffic operating in Tokyo FIR Oceanic airspace establish CPDLC connections).

1.2 Tokyo ACC intends to use ADS reports (ADS waypoint change event reports) for ATS data link capable aircraft as the primary means of surveillance in the near future, expecting more efficient use of ATS data link by reducing both pilot and controller workload, network load, human errors and operational cost. When the ADS based surveillance system is implemented, all of the position reports using CPDLC and HF voice communication are no longer required, and ADS contracts and reports are automatically processed by the systems of both airborne and ground without any human intervention. For the surveillance purpose, the CPDLC and HF voice will become the back-up means.

**2. PURPOSE OF THIS ANALYSIS**

2.1 The purpose of this review is to provide the ATSU with the information on the benefits of applying ADS report as the primary means of surveillance by ceasing CPDLC position report in the remote continental and oceanic airspace.

### **3. ANALYSES**

3.1 The sample of CPDLC messages was collected from the recorded CPDLC logs at Tokyo ACC during a month of 1 – 31 March 2004. The total number of the downlink messages was 26,648, and the up-link message was 14,581. Out of these down linked, the number of ‘POSITION REPORT’ messages was 13,023 that accounts for 49 percent (%) of all the downlinks. (Appendix-1 and -2)

3.2 In the case of abolishing CPDLC position report requirement, there still remain the messages that should not be omitted. According to the analysis of CPDLC messages made by JCAB CRA, about 20 percent (%) of CPDLC position reports were down linked following the initial connections with ATSUs. As prescribed in the FANS-1/A Operations Manual, the aircraft should send its current position report by CPDLC, when the connection established.

3.3 When an ADS waypoint report was missing and the aircraft is in overdue situation, the controller should request the aircraft position by up-linking ‘REQUEST POSITION REPORT’ or by HF voice. In this case, the pilot should send its ‘POSITION REPORT’ message to the controller. According to a review made by JCAB CRA, the ATC waypoint reports down linked by CPDLC in response to ‘REQUEST POSITION REPORT’ were estimated to be about 6 percent (%) of the total number of ‘POSITION REPORT’ messages.

3.4 From the paragraph 3.2 and 3.3, 26 percent (%) gained by adding 20% and 6% of all the CPDLC position reports, that are estimated about 3,400 reports, should not be omitted. The number of omissible CPDLC position reports by aircraft is, therefore, estimated to be about 9,600 messages which account for 36 percent of all sorts of CPDLC messages down-linked from aircraft.

### **4. DISCUSSIONS**

4.1 This paper provides data, as conclusion, on an estimated rate of omissible CPDLC messages, in the case of CPDLC position reports were to be substituted by ADS waypoint event reports, but does not prepare data on the quantity of such individual benefits obtainable as reductions in operational cost, increase of operational safety or network load reduction.

4.2 Paragraph 3.4 shows that 36 percent of the CPDLC down-link messages can be spared. On the other hand, the amount of controller’s workload reduction could not be measured because there was no appropriate material found for controllers to cope with the situation resulted from the ‘omitting position reports’. It is believed, however, that, by those omissions, controllers do not need to handle the CPDLC position reports displayed on the screen and are released from that sort of data processing tasks.

4.3 In this implementation, there may be some problems in ATC operations. One of them is that controllers will be unable to detect ‘overdue aircraft’, because all the ADS position data are processed automatically by the system. Accordingly, ATC systems need to be equipped with a tool for situation awareness to warn controllers of the overdue situation. Additionally, it is desired that the ATC system is capable of dealing with the overdue situations by up-linking ‘REQUEST POSITION REPORT’ automatically to the aircraft whenever an overdue aircraft was detected.

4.4 ATC operations need the predicted data at the next ATC waypoint, but because of the characteristics of avionics, the reported ADS data for the next waypoint are not always for the ATC waypoints, but for those of FMS database data which are sometimes different from the ATC waypoint. To deal with this problem, controllers have to uplink a message of 'CONFIRM NEXT WAYPOINT' to obtain the required predictive data at next ATC waypoint in daily operations. As a solution to this inconvenience, the ATC system may be required of providing an additional function of up-linking the message of 'CONFIRM NEXT WAYPOINT' automatically, instead of bothering controllers about their handworks.

## 5. CONCLUSION

5.1 By omission of CPDLC waypoint reports, the pilot's workload for CPDLC operation will be lessened by an estimate of 36 percent, and the controller's workload, network load and operational cost will also be reduced as well.

5.2 Some inconveniences to ATC operations created by omitting CPDLC waypoint report are foreseen, because of the characteristics of ADS report. However, this could be resolved the system.

## 6. ACTION BY THE MEETING

6.1 The meeting is invited to discuss about the benefits of ceasing the CPDLC reports at the ATC waypoints and about the measures to resolve the inconveniences created by the omission of CPDLC position reports.

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### *References:*

- (1) RASMAG/2 WP/10: *Validation of applicability of ADS report to surveillance Oct.4 2004*  
JCAB Central Reporting Agency
- (2) CPDLC Uplink: *Frequency of Message Usage by Controllers, March 2004, JCAB CRA ATS Datalink Website*
- (3) CPDLC Downlink: *Frequency of Message Usage by Pilots, March 2004, JCAB CRA ATS Datalink Website*
- (4) FANS 1/A *Operations Manual, 5.8 Position Reporting, 5 CPDLC Procedures*
- (5) FANS 1/A *Operation Manual, 5.9 FANS 1/A CPDLC Message Set and Inten*



**CPDLC DOWNLINK MESSAGES USED BY PILOTS IN TOKYO FIR  
(1-31 MARCH 2004)**

| Msg.ID | Message                                                                | No.of msg. | %     |
|--------|------------------------------------------------------------------------|------------|-------|
| 048    | POSITION REPORT [positionreport]                                       | 13023      | 48.87 |
| 000    | WILCO                                                                  | 6460       | 24.24 |
| 009    | REQUEST CLIMB TO [altitude]                                            | 2118       | 7.95  |
| 072    | REACHING [altitude]                                                    | 1925       | 7.22  |
| 003    | ROGER                                                                  | 1462       | 5.49  |
| 067    | [freetext]                                                             | 768        | 2.88  |
| 043    | NEXT WAYPOINT ETA [time]                                               | 145        | 0.54  |
| 006    | REQUEST [Altitude]                                                     | 121        | 0.45  |
| 008    | REQUEST CRUISE CLIMB TO [altitude]                                     | 81         | 0.30  |
| 010    | REQUEST DESCENT TO [altitude]                                          | 80         | 0.30  |
| 002    | STANDBY                                                                | 60         | 0.23  |
| 053    | WHEN CAN WE EXPECT HIGHER ALTITUDE                                     | 52         | 0.20  |
| 007    | REQUEST BLOCK [altitude] TO [altitude]                                 | 45         | 0.17  |
| 032    | PRESENT ALTITUDE [altitude]                                            | 35         | 0.13  |
| 063    | NOT CURRENT DATA AUTHORITY                                             | 35         | 0.13  |
| 018    | REQUEST [speed]                                                        | 33         | 0.12  |
| 001    | UNABLE                                                                 | 31         | 0.12  |
| 011    | AT [position] REQUEST CLIMB TO [altitude]                              | 28         | 0.11  |
| 062    | ERROR [errorinformation]                                               | 24         | 0.09  |
| 027    | REQUEST WEATHER DEVIATION UP TO [Distance offset] [Direction] OF ROUTE | 23         | 0.09  |
| 041    | BACK ON ROUTE                                                          | 20         | 0.08  |
| 025    | REQUEST CLEARANCE                                                      | 11         | 0.04  |
| 040    | ASSIGNED ROUTE [routeclearance]                                        | 11         | 0.04  |
| 054    | WHEN CAN WE EXPECT CRUISE CLIMB TO [altitude]                          | 10         | 0.04  |
| 034    | PRESENT SPEED [speed]                                                  | 8          | 0.03  |
| 015    | REQUEST OFFSET [Distance offset] [Direction] OF ROUTE                  | 6          | 0.02  |
| 022    | REQUEST DIRECT TO [Position]                                           | 6          | 0.02  |
| 031    | PASSING [Position]                                                     | 5          | 0.02  |
| 020    | REQUEST VOICE CONTACT                                                  | 4          | 0.02  |
| 004    | AFFIRM                                                                 | 3          | 0.01  |
| 012    | AT [Position] REQUEST DESCENT TO [Altitude]                            | 2          | 0.01  |
| 024    | REQUEST [routeclearance]                                               | 2          | 0.01  |
| 037    | LEVEL [altitude]                                                       | 2          | 0.01  |
| 076    | REACHING BLOCK [Altitude] TO [Altitude]                                | 2          | 0.01  |
| 013    | AT [time] REQUEST CLIMB TO [altitude]                                  | 1          | 0.00  |
| 016    | AT [Position] REQUEST OFFSET [Distance offset] [Direction] OF ROUTE    | 1          | 0.00  |
| 033    | PRESENT POSITION [Position]                                            | 1          | 0.00  |
| 038    | ASSIGNED ALTITUDE [Altitude]                                           | 1          | 0.00  |
| 050    | WHEN CAN WE EXPECT [Speed] TO [Speed]                                  | 1          | 0.00  |
| 052    | WHEN CAN WE EXPECT LOWER ALTITUDE                                      | 1          | 0.00  |
| 077    | ASSIGNED BLOCK [Altitude] TO [Altitude]                                | 1          | 0.00  |

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**CPDLC UPLINK MESSAGES USED BY CONTROLLERS AT TOKYO ACC OCEANIC SECTORS  
(1-31 MARCH 2004)**

| Msg.ID | Message                                                       | No.of msg. | %     |
|--------|---------------------------------------------------------------|------------|-------|
| 117    | CONTACT [icaounitname][frequency]                             | 3813       | 26.15 |
| 160    | NEXT DATA AUTHORITY [icaofacilitydesignation]                 | 2067       | 14.17 |
| 161    | END SERVICE                                                   | 1716       | 11.77 |
| 020    | CLIMB TO AND MAINTAIN [altitude]                              | 1701       | 11.66 |
| 001    | STANDBY                                                       | 1372       | 9.41  |
| 147    | REQUEST POSITION REPORT                                       | 794        | 5.44  |
| 000    | UNABLE                                                        | 730        | 5.01  |
| 141    | CONFIRM NEXT WAYPOINT ETA                                     | 577        | 3.96  |
| 169    | [freetext]                                                    | 300        | 2.06  |
| 106    | MAINTAIN [speed]                                              | 271        | 1.86  |
| 116    | RESUME NORMAL SPEED                                           | 236        | 1.62  |
| 148    | WHEN CAN YOU ACCEPT [altitude]                                | 220        | 1.51  |
| 108    | MAINTAIN [speed] OR GREATER                                   | 117        | 0.80  |
| 019    | MAINTAIN [altitude]                                           | 95         | 0.65  |
| 109    | MAINTAIN [speed] OR LESS                                      | 78         | 0.53  |
| 003    | ROGER                                                         | 69         | 0.47  |
| 023    | DESCEND TO AND MAINTAIN [altitude]                            | 64         | 0.44  |
| 159    | ERROR [errorinformation]                                      | 58         | 0.40  |
| 133    | CONFIRM ALTITUDE                                              | 51         | 0.35  |
| 118    | AT [position] CONTACT [icaounitname][frequency]               | 48         | 0.33  |
| 030    | MAINTAIN BLOCK [altitude] TO [altitude]                       | 33         | 0.23  |
| 082    | CLEARED TO DEVIATE UP TO [distanceoffset][direction] OF ROUTE | 29         | 0.20  |
| 168    | DISREGARD                                                     | 29         | 0.20  |
| 175    | REPORT REACHING [altitude]                                    | 24         | 0.16  |
| 134    | CONFIRM SPEED                                                 | 13         | 0.09  |
| 151    | WHEN CAN YOU ACCEPT [Speed]                                   | 13         | 0.09  |
| 004    | AFFIRM                                                        | 8          | 0.05  |
| 130    | REPORT PASSING [position]                                     | 6          | 0.04  |
| 021    | AT [time] CLIMB TO AND MAINTAIN [Altitude]                    | 5          | 0.03  |
| 127    | REPORT BACK ON ROUTE                                          | 5          | 0.03  |
| 137    | CONFIRM ASSIGNED ROUTE                                        | 5          | 0.03  |
| 002    | REQUEST DEFERRED                                              | 4          | 0.03  |
| 053    | CROSS [position] AT OR AFTER [time]                           | 4          | 0.03  |
| 120    | MONITOR [icaounitname][frequency]                             | 3          | 0.02  |
| 138    | CONFIRM TIME OVER REPORTED WAYPOINT                           | 3          | 0.02  |
| 007    | EXPECT CLIMB AT [time]                                        | 2          | 0.01  |
| 013    | AT [time] EXPECT CLIMB TO [altitude]                          | 2          | 0.01  |
| 031    | CLIMB TO AND MAINTAIN BLOCK [Altitude] TO [Altitude]          | 2          | 0.01  |
| 129    | REPORT LEVEL [altitude]                                       | 2          | 0.01  |
| 135    | CONFIRM ASSIGNED ALTITUDE                                     | 2          | 0.01  |
| 149    | CAN YOU ACCEPT [Altitude] AT [Position]                       | 2          | 0.01  |
| 008    | EXPECT CLIMB AT [position]                                    | 1          | 0.01  |
| 022    | AT [position] CLIMB TO AND MAINTAIN [Altitude]                | 1          | 0.01  |
| 032    | DESCEND TO AND MAINTAIN BLOCK [Altitude] TO [Altitude]        | 1          | 0.01  |
| 052    | CROSS [position] AT OR BEFORE [time]                          | 1          | 0.01  |
| 069    | REJOIN ROUTE BY [Time]                                        | 1          | 0.01  |
| 072    | RESUME OWN NAVIGATION                                         | 1          | 0.01  |
| 128    | REPORT LEAVING [Altitude]                                     | 1          | 0.01  |
| 132    | CONFIRM POSITION                                              | 1          | 0.01  |
| 143    | CONFIRM REQUEST                                               | 1          | 0.01  |
| 150    | CAN YOU ACCEPT [Altitude] AT [Time]                           | 1          | 0.01  |

— END —