The Twenty-First Meeting of the Informal South Pacific ATS Coordinating Group (ISPACG/21)

Auckland, New Zealand, 5-9 March 2007

Agenda Item 4:
Implementation of 30/30

Summary of Issues of Concern and Anomalies Discovered During the Operational Trial of 30 NM Lateral / 30 NM Longitudinal Separation Standards (30/30) In the Oakland Flight Information Region

(Presented by the Federal Aviation Administration)

SUMMARY

This information paper presents a summary of anomalies discovered during the operational trial of 30 NM lateral / 30 NM longitudinal separation standards (30/30) in the Oakland Oceanic Flight Information Region. This information was prepared for the Oceanic Separation Reduction Working Group (OSRWG) Scrutiny Group, which was formed to evaluate performance of various components of the system supporting the reduced separation minima. Included in this paper are anomalies, or unanticipated differences in certain aspects of system performance, uncovered to date in the course of the operational trial.

1. Introduction

1.1. The U.S. Federal Aviation Administration (FAA) began use of 30 NM lateral / 30 NM longitudinal separation standards (30/30) in a portion of the Oakland Oceanic Flight Information Region (FIR) on 22 December 2005. Introduction of these separation minima was made on an operational trial basis, accompanied by data collection, analysis and review of results.

1.2. The purpose of this information paper is to present anomalies, or unanticipated differences in certain aspects of system performance, uncovered to date in the course of the operational trial.

2. Background

2.1. FAA introduced operational trial use of 30-nm lateral and longitudinal separation in sector 3 of Oakland oceanic airspace, between pairs of aircraft with State Approval for Required Navigation Performance (RNP) 4 and appropriate data link operations, following applicable International Civil Aviation Organization requirements set out in Annex 11 and ICAO document 4444. As a practical matter, the operational trial is limited to aircraft equipped with the Future Air Navigation System (FANS) package and approved for RNP-4 operation.

2.2. A key contributor to the application of the reduced separation minima is the heightened level of tactical air traffic control possible with FAA's new oceanic automation system, Ocean21. This system also provides the means of collecting data for evaluation of overall system performance during the operational trial.

2.3. FAA has formed a Scrutiny Group (SG) in order to review the results of system performance during the operational trial. The SG is composed of representatives from various FAA organizations, including specialists in oceanic air traffic control and engineering operations from Oakland Center (ZOA), as well as representatives from Headquarters air traffic services, the Flight Standards Service and the Aircraft Certification Service.

2.4. The SG has met four (4) times since the start of the operational trial, reviewing system performance results summarized by the FAA Technical Center (TC) from Ocean21 data archives provided by ZOA. At each meeting, the SG has agreed that some aspects of observed system performance presented by the TC do not appear to conform to expectations based on equipment requirements or approved procedures. The SG identified these anomalies as areas of concern that must be to be corrected, understood or mitigated. A list of the areas of concern is included in Appendix A. The following section summarizes these anomalies.

3. Discussion

3.1. The FAA TC is provided with historical Ocean21 data reduction archives covering all of ZOA Oceanic operations. The data contain information pertinent to the performance of key systems in OC3, the location of the operational trial, as well as all of ZOA-controlled international airspace.

3.2. A summary of airspace characteristics presented to the SG is contained within Reference 1. The data presented thus far to the SG cover the period from 22 December 2005 through 31 January 2007.

3.3. Availability of Ground Earth Stations (GES)

3.3.1. Due to the GES problems, message traffic from one of the communication service providers has been affected during the operational trial. The effect of these outages precludes the reception of datalink messages during outage times. The SG is monitoring the frequency and duration of unplanned outages and evaluating the impact of outages on operations.

3.4. Observed Downlink Transit Times for ADS-C Messages & Related Anomalies

3.4.1. In a new, recently provided Ocean21 data set, downlink transit times are provided along with service provider information for each Ocean21 message. Figures 1 and 2 present the observed downlink performance by provider in relation to FOM targets.

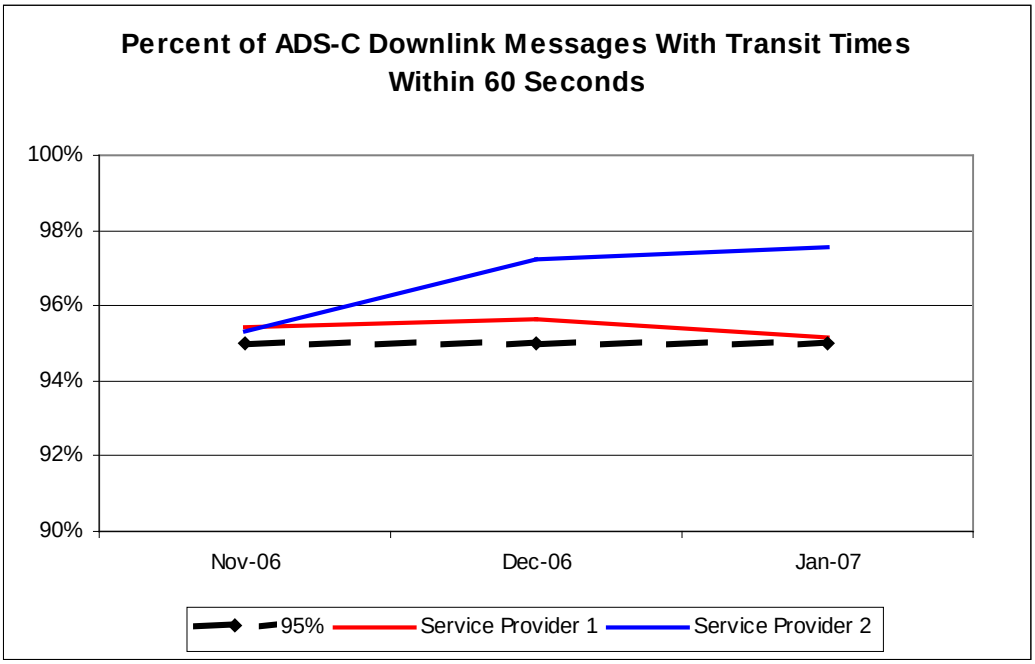

Figure 1. Percent of ADS-C Downlink Messages with Transit Times ≤ 60 Seconds

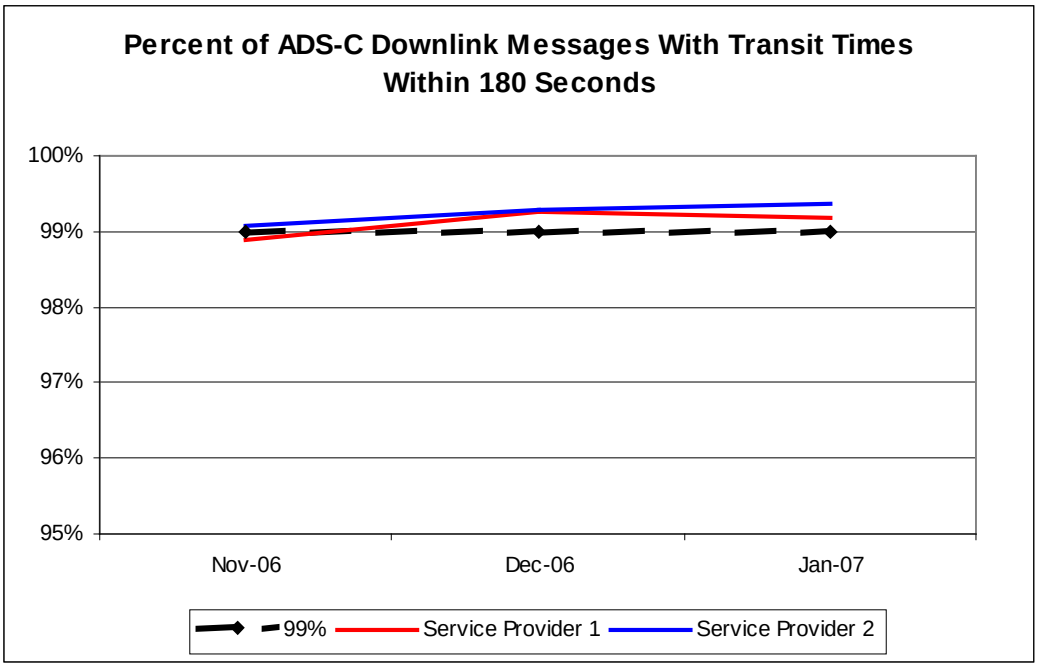

Figure 2. Percent of ADS-C Downlink Messages with Transit Times ≤ 180 Seconds

3.4.2. The ADS output message parameters presented in table 4.5-4 of reference 2, indicate the range for the time stamp parameter is 0 – 3,599.875 sec. This range had a limiting effect on the position time sent in the basic group and the predicted route group from the aircraft. The largest allowable unit for the position time and estimated time over position is minutes; the hour in the time data is not sent from the aircraft. Ocean21

applies the hour to the submitted position time and the predicted route group times during the decoding process.

3.4.3. When significant downlink delays are realized, the data show the incorrect hour applied to the position time and the predicted route group times. ZOA initiated an Ocean21 program trouble report (PTR) for purposes of remedying this problem.

3.5. Missing Basic Periodic Reports

3.5.1. Additional analysis includes examination to ensure that the requirements for the implementation and continued safe use of 30/30 contained in the PANS ATM are met. One such requirement states that when an ADS periodic or waypoint change report is overdue by three (3) minutes, a replacement report should be obtained as soon as possible; if overdue by six (6) minutes, any potential conflict should be resolved as soon as possible.

3.5.2. Each instance in Ocean21 data of a missing basic periodic report is identified and investigated. The investigation analyzes the data to determine whether a periodic request report (with interval equal to 0 seconds) was sent approximately three (3) minutes after the position report was overdue; this action is termed an 'interrogation' during the analyses. The result of this investigation places each instance into one of three categories:

- Evidence of 3-minute interrogation and reply observed in data;
- Evidence of 3-minute interrogation but no reply observed in data; or
- No evidence of 3-minute interrogation in data.

3.5.3. An additional investigation determines if there is evidence that the ADS contract had been cancelled or reset prior to or after the expected time of the missing basic periodic report. Figure 3 presents a summary of missing basic periodic messages including only those messages from aircraft whose ADS contract appeared 'active' at the time of the overdue report.

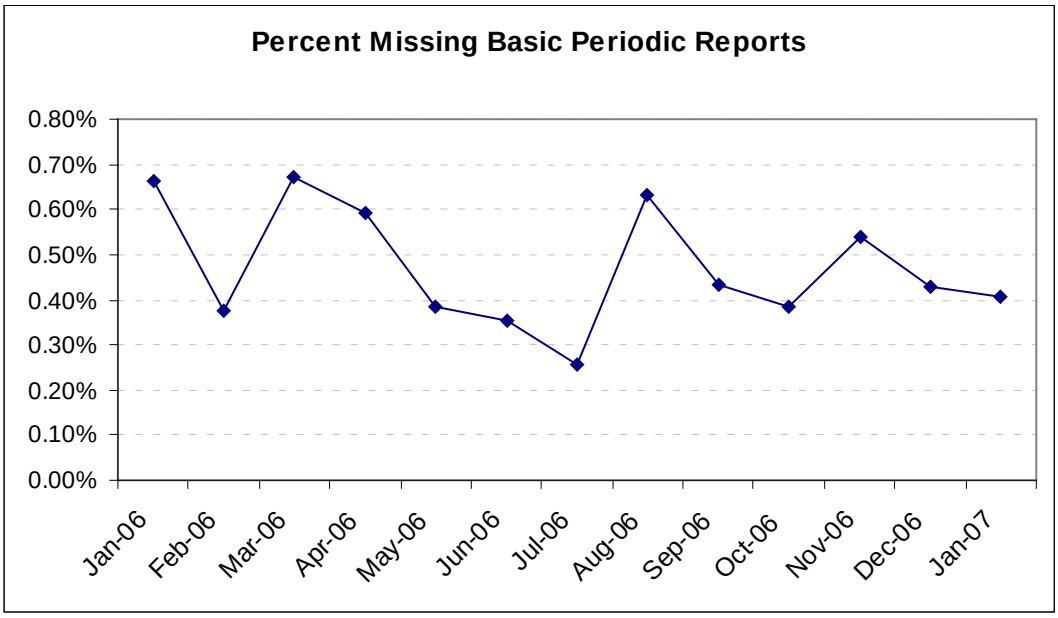

Figure 3. Percent of Missing Basic Periodic Reports January 2006 – January 2007

3.5.4. The average percent of missing basic periodic reports from aircraft whose ADS contracts appear 'active,' as shown in Figure 3, is 0.47, which is equivalent to approximately 437 messages a month or 14 messages a day. The SG requested that further analysis be completed on these data.

3.6. Lateral Deviation Contract (LDC) Events

3.6.1. As part of its basic ADS contract, each aircraft is required to report an actual deviation from cleared route if the deviation exceeds a threshold set in the contract. Such special ADS reports are termed lateral deviation contract (LDC) reports. The threshold for such a report is typically set to 5 NM. In addition, when a controller grants a weather deviation, Ocean21 resets the threshold to the maximum cleared deviation plus 5 NM. Each LDC report is analyzed, and the actual lateral deviation from the cleared route and the predicted route group is computed. After observing unexpected results in the presentation of these calculations, the SG has requested additional analysis. Reference 3, addresses the additional analyses and available results.

3.6.2. The SG has recommended that Flight Crew and air traffic control procedures be reviewed to ensure that actions appropriate to the LDC circumstances are being followed properly.

3.6.3. Instances in which LDC reports are received by Ocean21, indicating a deviation from the cleared route of greater than or equal to 5 NM, without prior ATC clearance have been observed. These events have caused the SG to request further analysis by specialists supporting the operational trial evaluation.

3.7. Duplicate Downlink ADS Messages

3.7.1. The ADS downlink message types containing position reports include, among others, the basic periodic report, waypoint change report, and the lateral deviation change report. Analysis of Ocean21 data uncovered the presence of duplicate ADS downlink messages. In this case, 'duplicate' indicates that the same downlink message was received at least twice from the same aircraft at two (2) separate times (same flight and day were ensured).

3.7.2. Figure 4 shows the proportion of duplicate ADS downlink messages received at ZOA from January 2006 through January 2007. The proportion in Figure 4 represents the percent of all received ADS downlink messages.

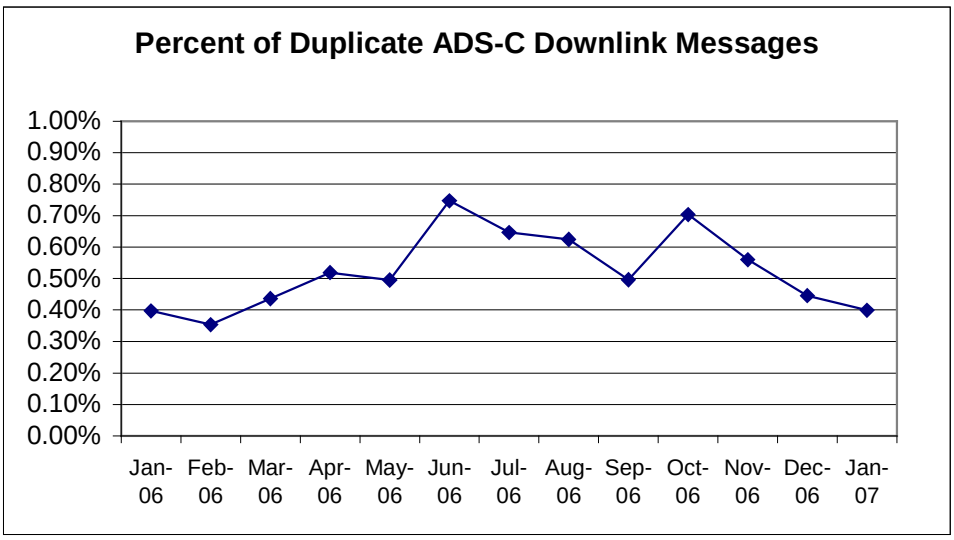

Figure 4. Percent of Duplicate ADS Downlink Messages from All ADS Downlink Messages Received at ZOA January 2006 – January 2007

3.7.3. From Figure 4, the average percentage of duplicate ADS downlink messages is 0.52%, which is equivalent to approximately 765 duplicate ADS messages per month or 25 duplicate ADS messages per day.

3.7.4. Each ADS position report contains a registration mark identifying the airframe. The registration marks from the duplicate ADS downlink messages were analyzed and matched to an aircraft type using various sources. Analysis of these duplicate messages indicates that certain operator/aircraft type combinations predominate. The results have been referred to the aircraft manufacturer for further examination.

3.8. ADS Uplink Messages With No Response

3.8.1. The Ocean21 data analyses developed for the SG examines all ADS uplink messages. The periodic contract request and event contract request uplink messages are expected to have a corresponding response message. Figure 5 presents the proportion of ADS uplink messages which do not have a corresponding response (acknowledgement or negative acknowledge message).

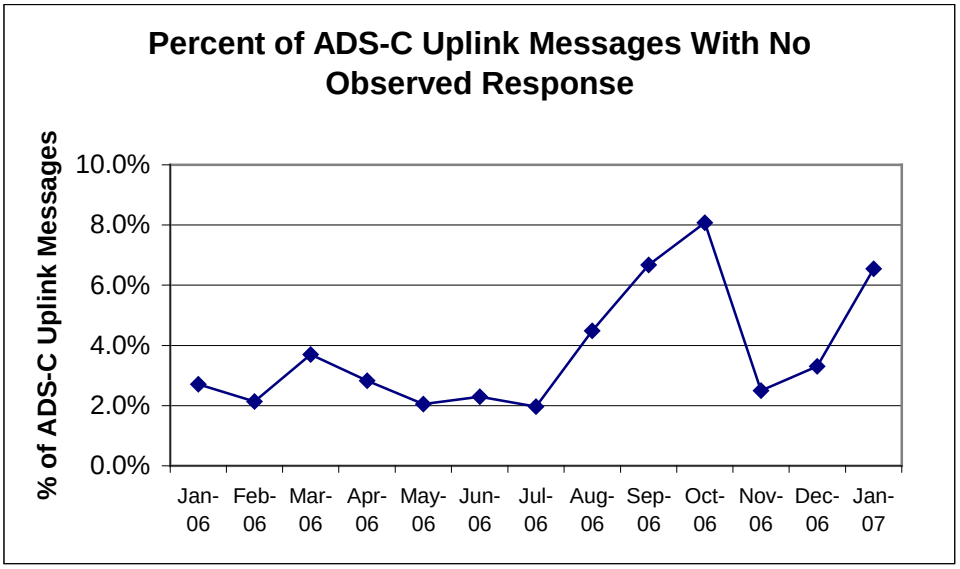

Figure 5. Percent of ADS Uplink Messages without an Observed Response in Ocean21 Data January 2006 – January 2007

3.8.2. From Figure 5, the average proportion of ADS uplink messages for which a response was not observed in the data is 3.8 percent or approximately 1255 messages per month (42 messages per day). Members of the SG indicated that a 'no response' from an aircraft during times of unexpected communication outages or large communication delays may cause the controller to initiate additional uplink report requests. These additional uplink report requests would potentially inflate the observed number of uplinks with no response.

4 Recommendations

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

References

1) "A Summary of Airspace Characteristics Related to the Operational Trial of 30 NM Lateral / 30 NM Longitudinal Separation Standards (30/30) in the Oakland Oceanic Flight Information Region (FIR)," IP/ RASMAG/6, Bangkok, Thailand, 6-10 November 2006.

2) "Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications," RTCA DO-258, September 13, 2000.

3) "Unexpected Automatic Dependent Surveillance (ADS) Lateral Deviation Change (LDC) Events," WP/15 RASMAG/6, Bangkok, Thailand, 6-10 November 2006.

Appendix A

OSRWG Scrutiny Group
Areas of Concern

1. Lost Messages
    a. Missing BAS, LDC, WPC, CPDLC messages
    b. Satellite beam coverage
2. Communication Outages
    a. ATOP data link interface loss
    b. GES outage and lack of redundancy
    c. Communications service provider ground network outage
    d. FAA ground network outage
3. Deviations
    a. Deviations due to weather (update rate?)
    b. Deviating from planned or cleared route of flight, including pilots deviating without requesting clearance
4. OCEAN21 not working as needed
    a. Undetected
    b. PTRs
    c. NCPs
5. Aircraft avionics
    a. Unknown defects
    b. Upgrades to avionics
    c. Known problems
        i. LDC at offset execution
6. Operational and procedural training
    a. Flight crews
    b. Controllers
7. Message transit times exceeding target
    a. Communications service provider performance
8. No validated communication performance based criteria