International Civil Aviation Organization

Thirty-Third Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/33)

Bali, Indonesia, Hybrid Meeting, 22 to 24 November 2022

Agenda Item 3.2: Performance Framework for Regional Air Navigation Planning and Implementation - ATM

ENVIRONMENTAL BENEFITS ACHIEVED FROM THE IMPLEMENTATION OF ENHANCED WAKE TURBULENCE SEPARATION AT THE HONG KONG INTERNATIONAL AIRPORT

(Presented by Hong Kong China)

SUMMARY

This paper shares the environmental benefits of implementing enhanced Wake Turbulence Separation (eWTS) at Hong Kong International Airport (HKIA). ICAO introduced an alternative means of re-categorization of wake turbulence categories – the Wake Turbulence Groups (WTG) based on wake generation and wake resistance characteristics of aircraft in 2020. Hong Kong China has implemented the distance-based eWTS separation minima based on the ICAO guidance as stipulated in Amendment 9 to PANS-ATM, Doc 4444 since 5 November 2020.

1. INTRODUCTION

1.1 Hong Kong China is consistently working on capacity enhancement initiatives to optimize the capacity of the air traffic management (ATM) system. Meanwhile, dedicated efforts are spent on fostering more environmentally sustainable operation modes for civil aviation through minimizing fuel burn and reducing Carbon Dioxide (CO_2) emission.

1.2 Final approach spacing between arrivals is one of the determining factors of runway capacity. In view of ICAO's introduction of the alternative means of re-categorization of wake turbulence categories into WTG, Hong Kong China has followed the ICAO Doc 4444 PANS-ATM Amendment 9 and implemented eWTS for arrivals at HKIA in November 2020. Successful implementation of eWTS with optimized final approach spacing at HKIA has improved both runway capacity and operating efficiency in a safe manner, with minimum investment in supporting infrastructure.

1.3 In the recent ICAO 41st Assembly, commitment from States on the reduction of carbon emission generated by aviation continued to be one of the key topics in the ICAO's global agenda. Aviation is one of the sources of the CO_2 emissions influencing global climate change. Air travel is also recognized as one of the carbon intensive activities an individual can make. In this regard, Hong Kong China has taken initiatives to facilitate maximizing aviation economic efficiencies and reducing CO_2 emissions.

1.4 A study was recently conducted to quantify the environmental benefits achieved after the implementation of eWTS at HKIA through estimating the reduced airborne delay during peak hours at HKIA. The result indicated that a significant amount of fuel had been saved and CO_2 emission had positively been reduced.

2. DISCUSSION

2.1 HKIA operates on a segregated mode of operation with the two runways, whereby the north runway 07L/25R is dedicated for arrivals. The application of eWTS between arrivals at HKIA has been successfully implemented since 5 November 2020.

2.2 With the implementation of eWTS, the maximum hourly runway capacity for arrivals at HKIA has been increased from 34 to 35 and progressively for more hours in a day. As controllers and pilots have become more accustomed to closer inter-arrival spacing and in the light of more operational experience gained, the maximum hourly arrival capacity at HKIA has rooms to be further increased to 36 in the coming 2023 Summer Schedule.

2.3 Environmental benefits of the implementation of eWTS for arrivals at HKIA

2.3.1. A study has recently been conducted to determine the relation between runway capacity and airborne delay. Before the implementation of eWTS, the maximum arrival capacity was 34 per hour. With the implementation of eWTS, the arrival capacity is progressively increased from 34 to 36. Assuming a total of 68 arrivals arrive at HKIA during a peak period of 2-hour duration, they could encounter a maximum 15-minute airborne delay before any air traffic flow management (ATFM) measures triggered. The effect of eWTS application on airborne delay reduction is estimated in Table 1 below. Details of the calculation is shown in **Appendix 1**.

	Hourly Arrival Capacity	**Total no. of Arrivals in a 2-hour Peak Period**	**Total Airborne Delay (mins)**	**Average Airborne Delay(mins) per flight**
Before eWTS	**34**	**68**	**1020**	**15**
After eWTS	**36**	**68**	**797**	**11.7**

Table 1

2.3.2. The analysis based on traffic and operational data, and ICAO Aircraft Engine Emissions Databank (https://www.icao.int/environmental-protection/pages/modelling-and-databases.aspx), shows a reduction of 223 minutes of airborne delay for a total of 68 flights is approximately equivalent to saving 15 tons of fuel (i.e. 47 tons of CO_2 emission). Since there could be as many as 3 arrival peak periods per day in the coming HKIA 2023 Summer Schedule, it is estimated that more than 16,500 tons of fuel could be saved and 52,000 tons of CO_2 emission could be reduced throughout a year. This is also equivalent to 120 round-trip flights from Hong Kong to London.

2.3.3. It is worth noting that for ATFM post operations analysis, the similar methodology could be applied for estimating fuel burn and emissions reductions in airborne delays. By using the ICAO Aircraft Engine Emissions Databank, airfleet and operations data, it is possible to quantify the fuel savings in the same way and thus realize CO_2 emissions and environmental benefits from applying ATFM measures.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) note the tangible environmental benefits achievable through implementation of improved operational measures, such as eWTS, for the achievement of the Long Term Aspiration Goal (LTAG) of net-zero carbon missions agreed at the 41st ICAO Assembly;

c) consider the implementation of eWTS at busy international airports so as to enhance the environmental sustainability of aviation industry; and

d) discuss any relevant matters as appropriate.

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Appendix 1

HOURLY ARRIVAL CAPACITY	34		36	
ARRIVAL SEQUENCE	Airborne Delay (mins)	ETA	ETA	Airborne Delay (mins) (=15 - diff. in ETA)
1	15	06:00:00	06:00:00	15.00
2	15	06:01:46	06:01:40	14.90
3	15	06:03:32	06:03:20	14.80
4	15	06:05:18	06:05:00	14.71
5	15	06:07:04	06:06:40	14.61
6	15	06:08:49	06:08:20	14.51
7	15	06:10:35	06:10:00	14.41
8	15	06:12:21	06:11:40	14.31
9	15	06:14:07	06:13:20	14.22
10	15	06:15:53	06:15:00	14.12
11	15	06:17:39	06:16:40	14.02
12	15	06:19:25	06:18:20	13.92
13	15	06:21:11	06:20:00	13.82
14	15	06:22:56	06:21:40	13.73
15	15	06:24:42	06:23:20	13.63
16	15	06:26:28	06:25:00	13.53
17	15	06:28:14	06:26:40	13.43
18	15	06:30:00	06:28:20	13.33
19	15	06:31:46	06:30:00	13.24
20	15	06:33:32	06:31:40	13.14
21	15	06:35:18	06:33:20	13.04
22	15	06:37:04	06:35:00	12.94
23	15	06:38:49	06:36:40	12.84
24	15	06:40:35	06:38:20	12.75
25	15	06:42:21	06:40:00	12.65
26	15	06:44:07	06:41:40	12.55
27	15	06:45:53	06:43:20	12.45
28	15	06:47:39	06:45:00	12.35
29	15	06:49:25	06:46:40	12.25
30	15	06:51:11	06:48:20	12.16
31	15	06:52:56	06:50:00	12.06
32	15	06:54:42	06:51:40	11.96
33	15	06:56:28	06:53:20	11.86
34	15	06:58:14	06:55:00	11.76
35	15	07:00:00	06:56:40	11.67
36	15	07:01:46	06:58:20	11.57
37	15	07:03:32	07:00:00	11.47
38	15	07:05:18	07:01:40	11.37
39	15	07:07:04	07:03:20	11.27

40	15	07:08:49	07:05:00	11.18
41	15	07:10:35	07:06:40	11.08
42	15	07:12:21	07:08:20	10.98
43	15	07:14:07	07:10:00	10.88
44	15	07:15:53	07:11:40	10.78
45	15	07:17:39	07:13:20	10.69
46	15	07:19:25	07:15:00	10.59
47	15	07:21:11	07:16:40	10.49
48	15	07:22:56	07:18:20	10.39
49	15	07:24:42	07:20:00	10.29
50	15	07:26:28	07:21:40	10.20
51	15	07:28:14	07:23:20	10.10
52	15	07:30:00	07:25:00	10.00
53	15	07:31:46	07:26:40	9.90
54	15	07:33:32	07:28:20	9.80
55	15	07:35:18	07:30:00	9.71
56	15	07:37:04	07:31:40	9.61
57	15	07:38:49	07:33:20	9.51
58	15	07:40:35	07:35:00	9.41
59	15	07:42:21	07:36:40	9.31
60	15	07:44:07	07:38:20	9.22
61	15	07:45:53	07:40:00	9.12
62	15	07:47:39	07:41:40	9.02
63	15	07:49:25	07:43:20	8.92
64	15	07:51:11	07:45:00	8.82
65	15	07:52:56	07:46:40	8.73
66	15	07:54:42	07:48:20	8.63
67	15	07:56:28	07:50:00	8.53
68	15	07:58:14	07:51:40	8.43
TOTAL AIRBORNE DELAY (MINS)	**1020**			**796.7**
AVG. AIRBORNE DELAY (MINS)	**15**			**11.7**
REDUCED DELAY (MINS)	**223.3**			
SAVED FUEL (TONS)	**14.9**			
CO2 EMISSION (TONS)	**47.1**			

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