



ICAO

International Civil Aviation Organization

Thirteenth Meeting of the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG/13)

Bangkok, Thailand, 03 – 07 April 2023

Agenda Item 4: Review of Current ATFM Operations and Problem Areas

**DIURNAL WIND VARIATION STUDY FOR RUNWAY CAPACITY OPTIMIZATION
AT HONG KONG INTERNATIONAL AIRPORT**

(Presented by Hong Kong China)

SUMMARY

This paper presents the runway capacity optimization efforts and its tangible benefits achieved through collaboration between the Air Navigation Service Provider (Hong Kong Civil Aviation Department) and the Meteorological Agency (Hong Kong Observatory) in Hong Kong China.

Through detailed analysis of historical surface wind data collected at the Hong Kong International Airport (HKIA), ‘Firebreaks’ are built in the seasonal scheduling capacity of the HKIA to match with the time with highest probability of runway change triggered by a diurnal wind variation. This in turn reduces possible delay to air traffic due to runway change in the strategic planning phase of ATFM.

1. INTRODUCTION

1.1 As highlighted in the ICAO Regional Framework document, close collaboration between Air Traffic Management (ATM) and Meteorology (MET) units is essential in all phases of ATFM.

1.2 Despite HKIA being an international hub airport with high traffic demand, there are certain intervals in the daily schedule of the airport whereby the declared runway capacity is strategically lowered. Hong Kong China implemented “firebreaks” since 2013 during these brief periods of reduction in declared runway capacity (normally one or two hours per interval) with a view to catering for routine events such as runway changes and act as buffers to absorb delays.

1.3 During every runway change at HKIA, a brief period of time (~ 6 minutes) with no runway movement is operationally required for ATC to switch on the relevant Instrument Landing System and reposition traffic to the new runway, which may induce a reduction of up to eight flight movements during that period.

1.4 A review of the schedule was carried out and a diurnal wind variation study was conducted to identify the hours in a day when a runway change is most likely to happen and to justify the insertion of such firebreaks among high schedule demand, thus serving the purposes of strategically optimizing operational efficiency and minimizing traffic delay.

2. DISCUSSION

2.1 A runway change is typically triggered by the change of wind direction and magnitude at the airport. Therefore, aligning the firebreaks with the results of the diurnal wind variation study could help reduce the overall traffic delay at the strategic planning phase of ATFM.

2.2 Historical daily wind data from anemometers located at various locations along the runways at HKIA were collected and analyzed. Occasions of tail wind of five knots or more with reference to runway-in-use were identified as a basis for the need of a runway change. A pattern of diurnal wind variation in general was observed and illustrated in Fig.1 and 2 below:

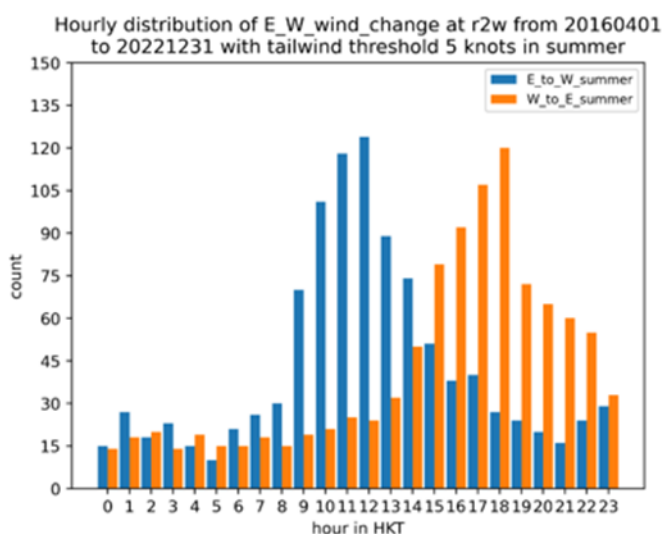


Figure 1: Hourly distribution of wind change at TDZ for RWY07C in Summer (Apr – Oct)

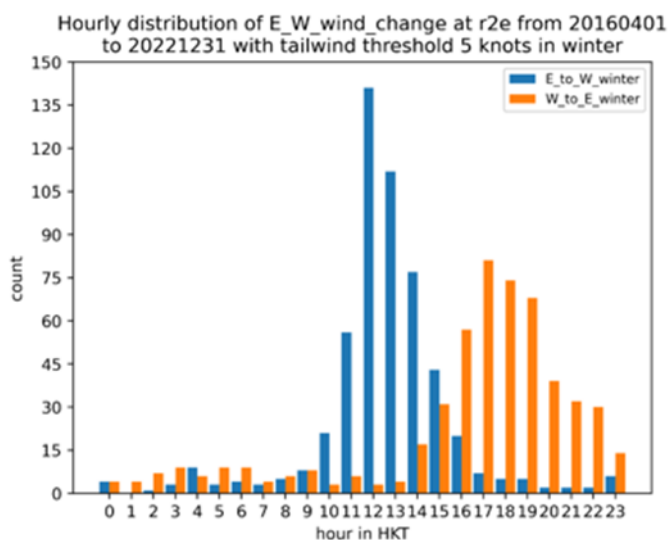


Figure 2: Hourly distribution of wind change at TDZ for RWY25C in Winter (Nov – Mar)

2.3 Inserting firebreaks at appropriate intervals of W22 and S23 schedule (see Fig.3 & 4) which tie in with the wind change patterns and correspond with higher runway change probability could potentially reduce airborne/ground delays induced by the change, thus minimizing the need of initiating ATFM measures.

Runway Capacity																								
Hour(UTC)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Arrivals	33	33	35	34	34	33	33	35	35	34	35	34	34	34	34	32	32	20	20	20	20	20	24	28
Departures	35	35	34	34	34	33	33	34	34	34	34	34	34	34	34	32	32	20	20	20	20	20	20	35
Total	68	68	69	68	68	64	65	69	69	68	69	68	68	65	64	64	64	38	32	32	32	32	32	63

Figure 3: HKIA 2022 Winter schedule

Runway Capacity																								
Hour(UTC)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Arrivals	33	33	35	34	34	34	34	35	35	34	34	36	34	34	34	32	32	20	20	20	20	20	24	28
Departures	35	35	34	34	34	34	34	34	34	34	34	34	34	34	34	32	32	20	20	20	20	20	20	35
Total	68	68	69	66	65	66	68	69	69	65	66	69	68	67	67	64	64	38	32	32	32	32	32	63

Figure 4: HKIA 2023 Summer schedule

Firebreaks

2.4 Tangible operational benefits are quantified below for reference:

	S23		
	MAX	MIN	AVG
Total Delay	9:00:00	0:00:00	4:30:00
AVG delay / FLT	0:04:09	0:00:00	0:02:05
FLT affected	130	0	65

Shifting the first firebreak

	S23		
	MAX	MIN	AVG
Total Delay	20:30:00	0:36:33	10:33:16
AVG delay / FLT	0:06:45	0:00:56	0:03:51
FLT affected	182	68	125

Shifting the second firebreak

2.5 The tangible operational benefits in para 2.4 above highlights the importance of collaboration between ANSP and MET agency.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) note the tangible operational benefits achievable through collaboration between ANSP and MET agency;
- c) share the strategies used in strategic phase of ATFM; and
- d) discuss any relevant matters as appropriate.

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