

**55th CONFERENCE OF
DIRECTORS GENERAL OF CIVIL AVIATION
ASIA AND PACIFIC REGIONS**

*Denarau Island, Nadi, Fiji
22 — 26 October 2018*

AGENDA ITEM 3 : AVIATION SAFETY

**REVISION IN SEPARATION STANDARD IN RVSM AIRSPACE
FOR SUPER HEAVY AIRCRAFT**

Presented by India

INFORMATION PAPER

SUMMARY

This paper presents an overview of the provisions related to Wake Turbulence Separation and addresses the concerns on incidents that took place between an A380 and B757/B737 in the RVSM airspace, in order to agree on measures that would mitigate the safety risk associated with similar occurrences.

Action by the meeting is at paragraph 3.

REVISION IN SEPARATION STANDARD IN RVSM AIRSPACE FOR SUPER HEAVY AIRCRAFT

1. INTRODUCTION

1.1 The provisions related to Wake Turbulence Minima are contained in PANS-ATM (ICAO Doc 4444) along with detailed characteristics of wake vortices and their effect on aircraft are contained in the Air Traffic Services Planning Manual (ICAO Doc 9426).

1.2 The term “wake turbulence” is used in this context to describe the effect of the rotating air masses generated behind the wing tips of large jet aircraft, in preference to the term “wake vortex” which describes the nature of the air masses.

1.3 Wake vortices are present behind every aircraft, but are particularly severe when generated by a large and wide-bodied jet aircraft. These vortices are two counter-rotating cylindrical air masses trailing aft from the aircraft. The vortices are most dangerous to following aircraft during the take-off, initial climb, final approach and landing phases of flight. They tend to drift down and when close to the ground move sideways from the track of the generating aircraft, occasionally rebounding upwards.

1.4 Flight tests have shown that vortices from large aircraft sink at a rate of about 2 to 2.5 m/s (400 to 500 ft/min). They tend to level off at about 275 m (900 ft) below the flight path of the generating aircraft. Wake turbulence strength diminishes with distance behind the generating aircraft.
DISCUSSION

2. DISCUSSION

2.1 The ICAO wake turbulence category is based on the maximum certified take-off mass, as follows:

- a) H (Heavy) aircraft types of 136000 kg (300000 lb) or more;
- b) M (Medium) aircraft types less than 136 000 kg (300000 lb) and more than 7000 kg (15500 lb); and
- c) L (Light) aircraft types of 7000 kg (15500 lb) or less.

Note: Super Heavy for Airbus A380 with a maximum take-off mass in the order of 560,000 kg.

2.2 The following distance-based wake turbulence separation minima is applied to aircraft in the approach and departure phases of flight:

Aircraft Category		
Preceding aircraft	Succeeding aircraft	Distance-based wake turbulence separation minima
Heavy	Heavy	7.4 km (4.0NM)
	Medium	9.3 km (5.0 NM)
	Light	11.1 km (6.0 NM)
Medium	Light	9.3 km (5.0 NM)

2.3 The minima set out in Para 2.2 is applied when:

- a) an aircraft is operating directly behind another aircraft at the same altitude or less than 300 m (1000 ft) below; or
- b) both aircraft are using the same runway, or parallel runways separated by less than 760 m (2500 ft); or
- c) an aircraft is crossing behind another aircraft, at the same altitude or less than 300 m (1000 ft) below.

2.4 Wake turbulence separation minima are intended to greatly reduce the potential hazards of wake turbulence. However, when the separation minima normally applied to Instrument Flight Rules (IFR) flights are greater than those for wake turbulence, no special measures need to be taken by Air Traffic Control (ATC).

2.5 Strategic Lateral Offset Procedures (SLOP)-PANS-ATM

In accordance with the international regulations for airspaces with Reduced Vertical Separation Minima (RVSM), the RVSM between airplanes with RVSM approval is 1,000 feet between FL290 and FL410.

ICAO Doc 4444 PANS-ATM (16th Edition November 2016) describes a so-called Strategic Lateral Offset Procedure (SLOP), which is defined as follows:

“SLOP are approved procedures that allow aircraft to fly on a parallel track to the right of the centre line relative to the direction of flight to mitigate the lateral overlap probability due to increased navigation accuracy, and wake turbulence encounters”.

In Indian Aeronautical Information Publication (AIP India) ENR 3.0-7, a total of 36 routes are given where SLOP procedure is being followed.

2.6 Wake Turbulence Concerns with Super Heavy Aircraft

2.6.1 On 13 June 2018, Blue Dart B757-200 aircraft registration VT-BDB operating flight from Kolkata to Delhi while approaching JAL VOR on R594 ATS route, encountered wake turbulence while cruising at FL380 due to reciprocal A380 aircraft maintaining FL390 and belonging to Singapore Airlines. As a result, Blue Dart B757-200 banked to the left with maximum bank angle reaching 61.2 degree. The aircraft was being flown on autopilot and recovered from wake turbulence after few seconds.

2.6.2 On 20 Feb 2017, Air India express B737 aircraft operating from Calicut to Muscat (Oceanic region) while cruising at FL 320 experienced wake turbulence due to reciprocal A380 aircraft flying at FL330. Air India Express crew selected roll mode HDG SEL to deviate from current track due to wake turbulence. The bank angle exceeded beyond 35 degree. Thereafter the crew followed the jet upset recovery procedure as per QRH during which aircraft banked upto 76 degree and loss of altitude of nearly 760 feet and as a result became reciprocal traffic to other aircraft at FL310. Aircraft received TA/RA with the second aircraft and followed the recovery procedure.

2.6.3 On 26 Oct 2015, Jet Airways B737-800 aircraft operating from Colombo to Mumbai while cruising at FL360 experienced wake turbulence due to reciprocal A380 aircraft cruising at FL370. B737-800 experienced bank upto 36.39 degree accompanied by loss of altitude of about 235 feet.

2.7 In all the above cases, although the flight crew were in positive contact with ATC, yet they were not aware of the reciprocal traffic in respect of type of aircraft. SLOP procedure did not cater solutions for this type of wake turbulence issues and SLOP procedures are not applicable to all routes. There is no guidance on proactively offsetting the reciprocal aircraft in case of super heavy and light & super heavy and medium aircraft.

3. ACTION BY THE MEETING

3.1 The Conference is invited to note:

- a) The concerns expressed by India in view of serious incidents in Indian airspace.
- b) The need to develop procedures related to wake turbulence in the RVSM airspace on proactively offsetting reciprocal traffic involving aircraft in super heavy category.

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