



Agenda Item 5: Collision risk assessment and LHD

**Creating positive safety impact through capture and analysis
of Strategic Lateral Offset Procedure (SLOP)**

(Presented by International Air Transport Association)

SUMMARY

IATA recommends SAT SOG implementation of processes and procedures in the SAT to analyze, monitor, disseminate the Strategic Lateral Offset Procedure (SLOP) uptake in the region to create positive safety impact in the region.

1. Introduction

1.1 The use of Strategic Offset Procedures (SLOP), designed to mitigate the effects of wake vortex in cruise as well as reduce the risks of mid-air collision and its application in calculating the vertical collision risk estimates is widely accepted as providing a positive safety impact when properly applied.

1.2 ICAO DOC 4444 "PANS ATM" guidance, states that SLOP should only be authorized in en-route oceanic or remote continental airspace. The routes or airspace where application of strategic lateral offsets is authorized and the procedures to be followed by pilots, should be promulgated in aeronautical information publications AIPs(s) by the concerned State(s) or, as applicable, by the authorized ANSP(s).

1.3 SLOP allows pilots to fly centerline or 1NM (1.85km) or 2NM (3.7km) to the right of the centerline within oceanic boundaries without informing ATC. It is designed to be a standard operating procedure specifically used to spread aircraft out laterally about their tracks, to minimize the chance of collision given an operational error or adoption of contingency procedure.

1.4 Aircraft flying offset tracks must have automatic offset tracking capability - something which is routinely provided in most modern Flight Management Systems (FMS). Flight crews determine the most suitable track using the best traffic information sources available to them. These may include RTF, ACAS, visual acquisition, and ADS-B. Communication with other aircraft in the vicinity using the air-to-air frequency 123.45 MHz may also facilitate useful co-ordination.

2. Discussion

2.1 The use of lateral offset by ADS-reporting aircrafts would enable the adequate capture of SLOP application in the SAT region as most aircraft are capable of being programmed with automatic offsets and operate in the North Atlantic (NAT) by applying this offset to both OTS and non-OTS flights.

2.2 In the SAT region, SLOP could be achieved by identifying the oceanic boundaries with which the procedure would be monitored, and analysis performed.

2.3 Since SLOP is designed to be a standard operating procedure specifically used to spread aircraft out laterally about their tracks when parallel routes centerlines are more than 30NM apart, to minimise the chance of collision given an operational error or adoption of contingency procedure, dense oceanic air traffic flows, such as the Europe and South America (EUR/SAM) corridor would be the airspace where specific monitoring and analysis could be accomplished.

SLOP Calculation

2.4 **Appendix A** of this document provides information on methods for incorporating SLOP into the vertical collision risk estimate. Furthermore, the NAT region already performed this analysis with the cooperation of NATS and could support the designated entity from the SAT in developing and performing the analysis.

2.5 Currently, on behalf of ICAO, NATS supplies quarterly NAT SLOP data performance via IATA to operators, who have in the past quarter been observed to have the largest populations of NAT crossings. The intention is that this information will assist NAT operators to encourage their crews to randomly select a SLOP offset which will move the lateral spread of aircraft to the optimal 33.3% on each offset.

3. Action by the Meeting

3.1 The SAT SOG is invited to:

- a) note the information provided;
- b) note the impact of SLOP uptake on the Target Level of safety calculation and vertical collision risk;
- c) discuss and agree to SLOP monitoring for the EURSAM corridor;
- d) decide on the State or agency that would conduct quarterly SLOP analysis; and
- a) provide direction as deemed necessary.

END

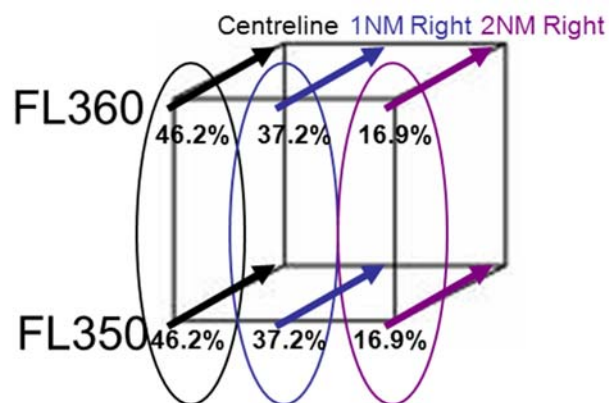
Appendix A

Method for incorporating SLOP estimates into the vertical collision risk estimate.

The effect of SLOP on $P_y(0)$ is different for same and opposite direction traffic depending on the usages of the offsets (i.e. 1NM Right or 2NM Right of track centreline).

Figure 1 shows the pairwise vertical interaction for same direction traffic, using illustrative flight levels and the SLOP proportions.

Figure 1: SLOP for same direction pairwise vertical interaction for same direction case

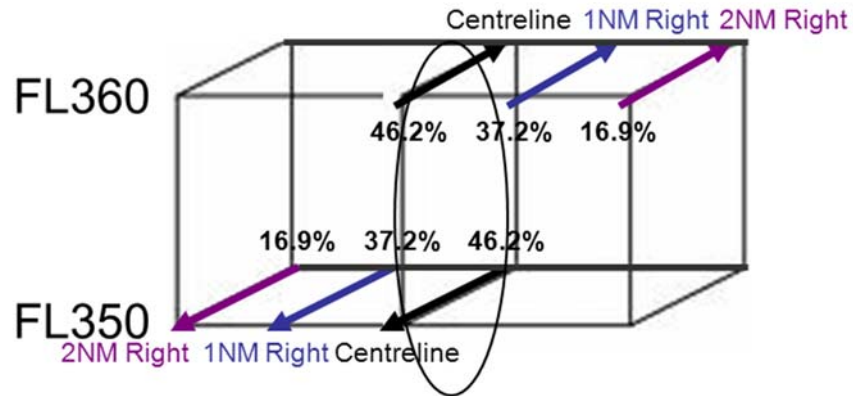


The total probability of pairwise vertical interaction for the same direction case is calculated by combining the proportions of traffic at each of the three options.

$$P_{V \text{ interaction (same)}} = 0.462^2 + 0.372^2 + 0.169^2$$

Figure 2 shows the pairwise vertical interaction for opposite direction traffic, using illustrative flight levels and the SLOP proportions.

Figure 2: SLOP for same direction pairwise vertical interaction for opposite direction case



This results in the following estimated probability of pairwise vertical interaction for opposite direction aircraft:

$$P_{V interaction (opp)} = 0.462^2$$

It can be seen that each of equations 1.3 to 1.5 follow a similar format shown in equation 4.

$$N_{az} = \{ \dots \} P_y(0) \frac{\lambda_x}{S_x} \left\{ E_z(\text{same})[\text{same direction crossing speeds}] + E_z(\text{opp})[\text{opposite direction crossing speeds}] \right\}$$

Eqn 1

Since the vertical interactions between aircraft pairs are different for same and opposite direction traffic, the resulting benefit that this has on $P_y(0)$ is also different for same and opposite direction cases. The kinematic factors for same and opposite direction traffic are also different and as a result of this the benefit of SLOP on $P_y(0)$ must be considered separately for same and opposite direction traffic. This creates equation 5, which sets out how the benefits of SLOP on the operational vertical risk are calculated.

$$N_{az} = \{ \dots \} \frac{\lambda_x}{S_x} \left\{ P_{V interaction (same)} P_y(0) E_z(\text{same})[\text{same direction crossing speeds}] + P_{V interaction (opp)} P_y(0) E_z(\text{opp})[\text{opposite direction crossing speeds}] \right\}$$

Eqn 5

The collision risk estimate (CRE) assumes a random distribution of SLOP based on the observed SLOP usage for the last quarter of the calendar year being assessed. The maximum contribution to the CRE would occur when there is an equal distribution of usage among the three options (0 nm, 1nm and 2nm).