Safety Notice

Libyan Civil Aviation Authority

SAFETY NOTICE

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En-route Wake Turbulence Encounters

This Safety Notice presents to enhance the awareness of operators, pilots and air traffic controllers of the risks associated with wake turbulence encounters in the en-route phase of flight

This Safety Notice contains recommendations regarding operational safety.

Recipients are asked to ensure that this Safety Notice is copied to all members of their staff who may have an interest in the information (including any 'in-house' or contracted Organisations and relevant outside contractors).

Issued By Flight Operations Section – Flight Safety Department

Head of Flight Operations Section
Abdelwahab Shugman

Applicability:

All aeroplane operators, pilots and air traffic controllers

Description:

With the increase of the overall volume of air traffic and enhanced navigation precision, wake turbulence encounters in the en-route phase of flight above 10 000 feet (ft) mean sea level (MSL) have progressively become more frequent in the last few years.

The aim of this SN is to enhance the awareness of pilots and air traffic controllers of the risks associated with wake turbulence encounters in the en-route phase of flight and provide recommendations and advisories with the purpose of mitigating the associated risks.

Every flying aircraft generates turbulence in its wake. For a fixed-wing aeroplane, this wake turbulence rolls-up into a pair of coherent, counter-rotating vortices that can persist for some minutes in the vicinity of the generating aeroplane flight path, moving generally downward and laterally with the wind. This poses a potential hazard to the safe flight of another aeroplane crossing or operating below the trajectory of the generating aeroplane, and encountering these vortices. The trailing vortices' intensity and time to dissipate depends upon factors as the weight, size and speed of the aeroplane, as well as prevailing atmospheric conditions. The relative size and weight of the generating aircraft in comparison to the affected aircraft is also a risk factor.

Wake turbulence encounters can occur during any phase of flight. Separation minima aim at preventing such encounters from inducing risk, but it must be noted that these provisions will not completely prevent wake encounters from occurring.

The basic effects of wake turbulence encounter on a following aeroplane are induced roll, vertical acceleration (can be negative) and loss or gain of altitude. The greatest danger is typically the induced roll that can lead to a loss of control and possible injuries to cabin crew and passengers.

En-route, the vortices evolves in altitudes at which the rate of decay leads to a typical persistence of 2-3 minutes, with a typical sink rate of about 400ft/min. Wakes will also be transported by wind.

Considering the high operating air speeds in cruise and the standard 1000 ft vertical separation in RVSM airspace, wake can be encountered up to 25 nautical miles (NM) behind the generating aeroplane. The most significant encounters are reported within a distance of 15 NM. However, no specific horizontal wake turbulence separation minima are detailed within PANS-ATM for en-route flight, with States utilizing procedural or surveillance-based separation minima.

The encounters are mostly reported by pilots as sudden and unexpected events. The awareness of hazardous traffic configuration and risk factors is therefore of particular importance to anticipate, avoid and manage possible wake encounters.

In the en-route phase of flight, three major factors contribute to increase the likelihood of wake turbulence:

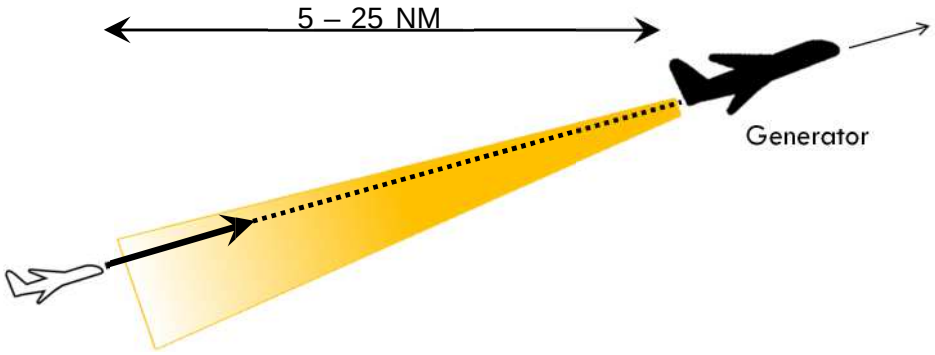
1. Crossing traffic situation: In the case that crossing traffic is climbing or descending in proximity (either the generating or following aeroplane), the wake generated might cross the follower's trajectory with minimum time for decay, so stronger wake turbulence might be encountered.

2. Thermal tropopause altitude: Wake vortex decays more slowly below the tropopause where there is therefore an increased risk of encountering severe wake turbulence.
3. Weight of the generating aeroplane: Heavier aeroplane types generate stronger wake vortices and are likely to induce more severe wake turbulence encounters, especially for smaller aeroplane types.

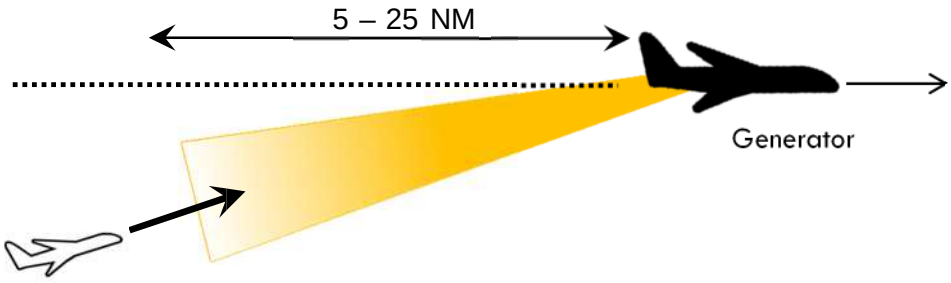
The typical hazardous trajectory crossing configurations are the following. They are shown hereafter in a vertical plane, although the respective flight path might also be crossing on the horizontal plane. When crossing horizontally, the lower the crossing angle the higher the wake effect. See the examples as shown on pages 3, 4 and 5 of this SN.

a) Follower climbing

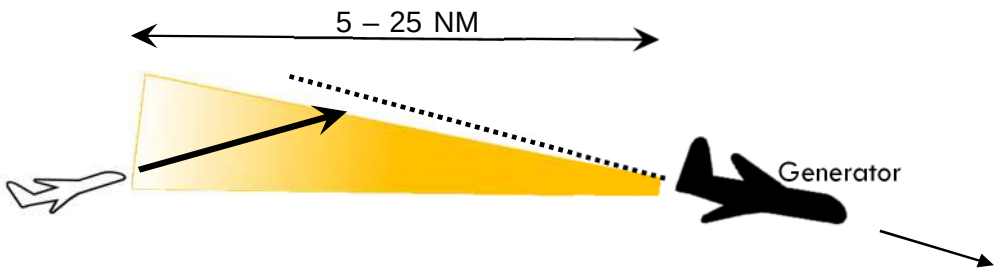
i. Generator climbing ahead



ii. Generator flying level

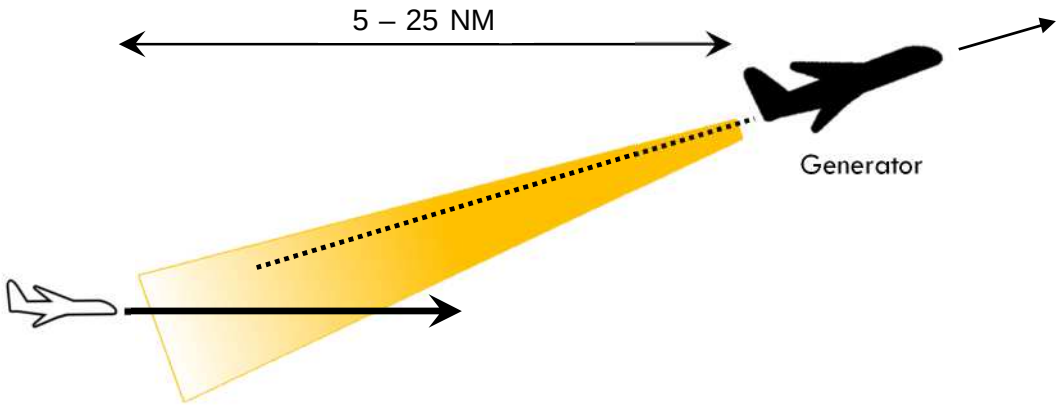


iii. Generator descending ahead

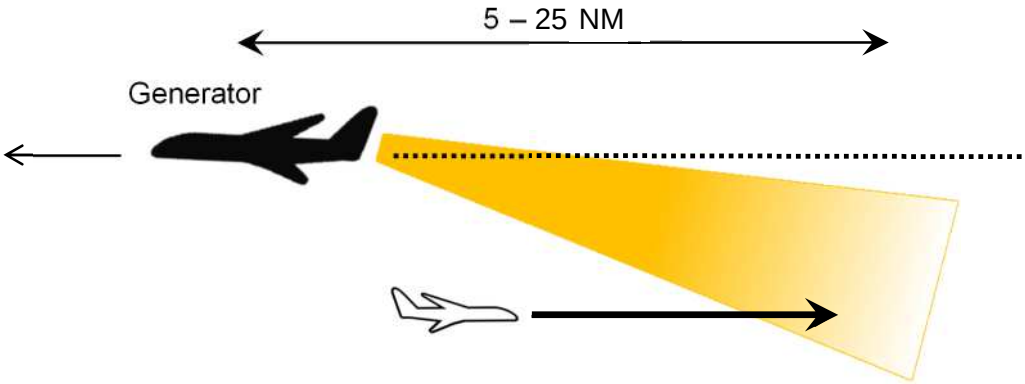


b) Follower flying level

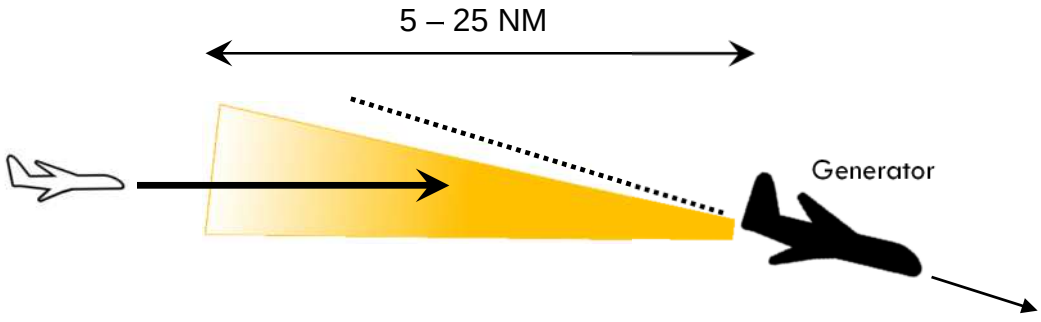
i. Generator climbing ahead



ii. Generator flying level - crossing above level in opposite direction

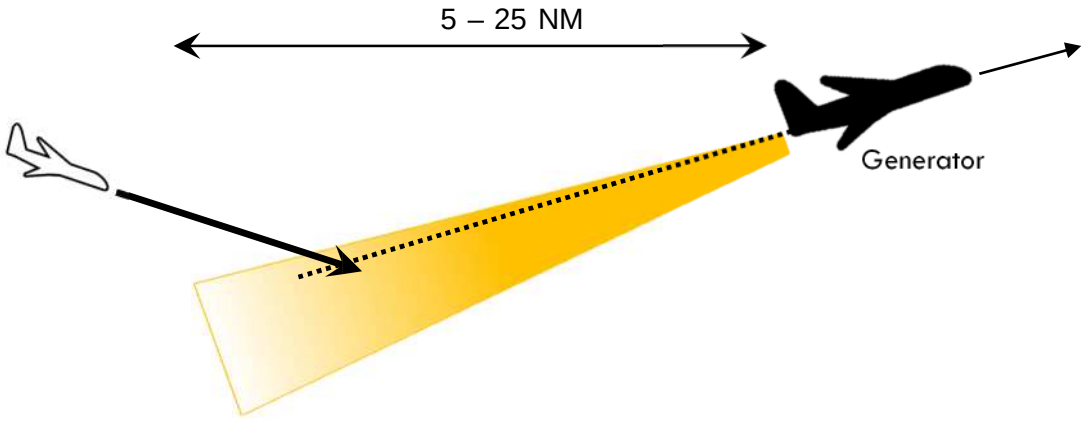


iii. Generator descending ahead

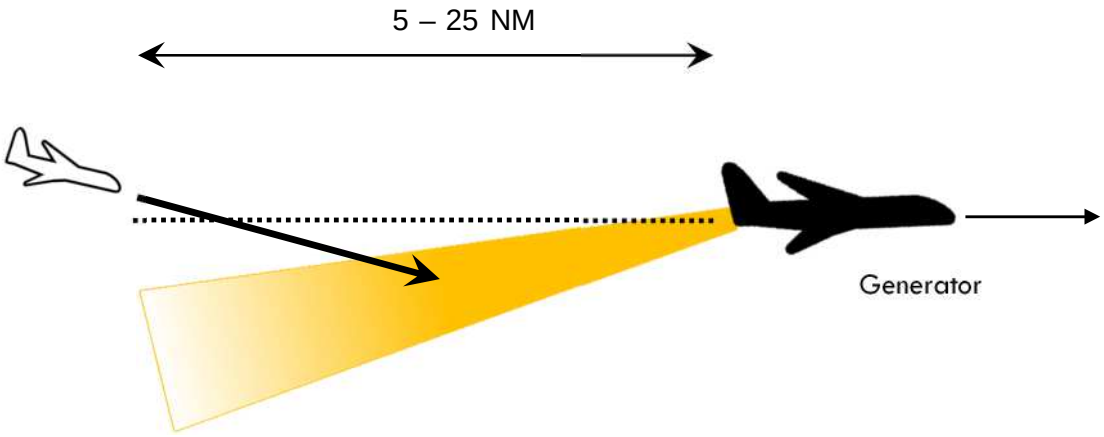


c) Follower descending

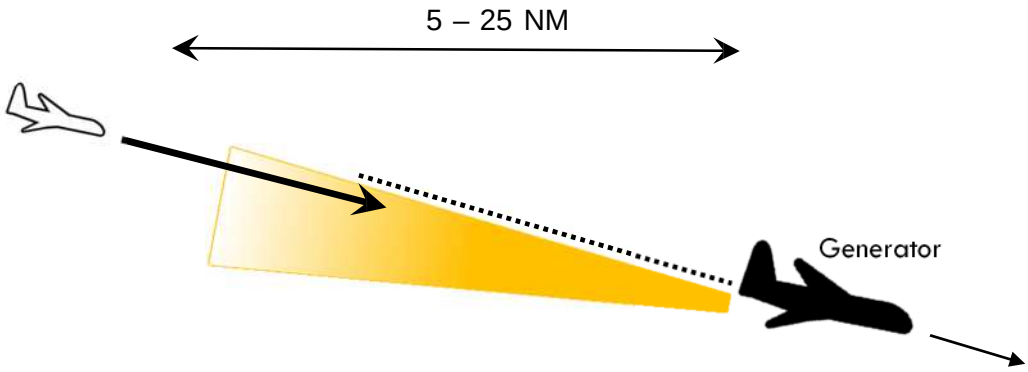
i. Generator climbing ahead



ii. Generator flying level



iii. Generator descending ahead



Note: The variability in the generator aeroplane rate of climb or descent makes it quite difficult to estimate exactly where the vortex is. Consequently, during the en-route phase of flight, Pilots should expect possible wake encounters when other traffics in proximity appear to be on similar tracks ahead, crossing above your level, climbing or descending ahead through your flight path, while wind direction is likely to move the wake towards your trajectory.

In the future, appropriate system support functions to also inform and warn Air Traffic Controllers of potentially hazardous wake encounters may be developed.

Recommendation(s):

As precautionary measures, operators and pilots should be aware that:

- As foreseen in LYCAR-AIR-OPS AMC1 to CAT.OP.MPA.170, the announcement to passengers should include an invitation to keep their seat belts fastened, even when the seat belt sign is off, unless moving around the cabin. This minimizes the risk of passenger injury in case of a turbulence encounter en-route (wake or atmospheric).

- As indicated in ICAO PANS-ATM, for aeroplanes in the Heavy wake turbulence category or Airbus A380-800, the word “HEAVY” or “SUPER”, respectively, should be included immediately after the aeroplane call sign in the initial radiotelephony contact between such aeroplanes and ATS units.

- When possible, condensation trails should be used to visualize wakes and estimate if their flight path brings them across.

- More attention should be given when flying below the tropopause altitude, as the likelihood of wake encounter increases. The tropopause altitude varies (between days, between locations) and can be found on meteorological charts.

- Upwind lateral offset should be used if the risk of a wake encounter is suspected, when allowed by airspace regulations or via specific ATC approval. Also, a change of FL to cross “HEAVY” or “SUPER” traffics from above can be used when feasible and authorized by ATC.

In case of a wake encounter, pilots should:

- Be aware that experience has demonstrated that if the pilot reacts at the first roll motion, when in the core of the vortex, the roll motion could be potentially amplified by this initial piloting action.
- Be aware that some in-flight incidents have demonstrated that pilot inputs may exacerbate the unusual attitude condition with rapid roll control reversals carried out in an “out of phase” manner.
- Be aware that if the autopilot is engaged, intentional disconnection can complicate the scenario, and the autopilot will, in most cases, facilitate the recovery.
- Try to avoid large rudder deflections that can create important lateral accelerations, which could then generate very large forces on the vertical stabilizer that may exceed the structural resistance. Although some recent aircraft types are protected by fly-by-wire systems, typically, the use of the rudder does not reduce the severity of the encounter nor does it improve the ease of recovery.
- Make use of specific guidance in the AOM (Aircraft Operating Manual) for their specific type(s)/fleet, where available.

Ref. Publications:

- LYCARs-AIR-OPS AMC1 to CAT.OP.MPA.170
- ICAO PANS-ATM-Doc 4444
- ICAO Doc 8643 Aircraft Type Designators and Doc 9426 Air Traffic Services Planning Manuel
- ICAO Airplane Upset Prevention and Recovery Training Aid- Revision 3

Queries

Any queries as a result of this Safety Notice should be addressed to Head of Flight Operations Section at the following e-mail address:

ops@flightsafety.caa.gov.ly

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