WAKE VORTEX TURBULENCE

With the world airline fleet expected to double in size over the next 15 years and the giant A380 entering service in 2006, solutions to the wake-vortex problem cannot come too soon for the European aerospace industry.

Crash follows encounter with Boeing 757 Wake Vortex

On 15 December 1993 a Boeing 757 & an Israel Aircraft Industries Westwind (WW) were vectored for landings on RWY 19R at Santa Ana—John Wayne Airport, USA. The 757 & WW were sequenced for visual approaches. Before being cleared for visual approach, the WW was closing 3.5nm behind the 757 on a converging course.

The 757 & WW crews were told to slow to 170kt due to a preceding aircraft. The 757 slowed below 150kt and was high on final approach with a 5.6° descent. The WW continued to converge to about 2.1nm behind the 757 on a 3° approach.

ATC did not specifically advise, nor was it required to advise the WW pilots that they were behind a Boeing 757. The WW captain discussed possible wake turbulence, flew the ILS one dot high, noted their closeness to the 757 & indicated there should be no problem. While descending through approximately 1,100ft AMSL the WW encountered wake turbulence from the 757, rolled into a steep descent & crashed.

The National Transportation Safety Board determined the probable causes of this accident as follows:

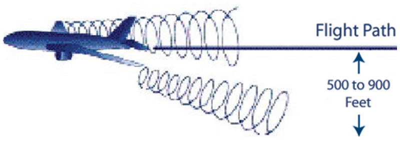
The pilot-in-command's failure to maintain adequate separation behind the Boeing 757 and/or remain above its flight path during the approach, which resulted in an encounter with wake vortices from the 757. Factors related to the accident were: an inadequacy in the ATC procedure related to visual approaches and VFR operations behind heavier airplanes, and the resultant lack of information to the Westwind pilots for them to determine the relative flight path of their airplane with respect to the Boeing 757's flight path.

Wake vortices are normally invisible and pilots have no warning that they are flying into one. For this reason, the International Civil Aviation Organisation (ICAO) lays down strict rules about the permitted spacing between aircraft, based on their size. In instrument flying conditions aircraft may follow no closer than three nautical miles (5.56km) [Between medium aircraft]*, and a small aircraft must follow at least six nautical miles (11.12km) behind a heavy jet such as a Boeing 747.

These separations are conservative: they do not completely avoid the effects of wake vortices, but they are sufficient to be safe in most meteorological conditions.

Nearly all airline pilots will have had encounters with vortices, usually on the final approach to airports. They are experienced as a buffeting of the aircraft. While of little concern to passengers and crew who are wearing seat belts at this stage, pilots regularly report minor injuries to crew members standing up or moving around the cabin. However, thanks to ICAO regulations on separations, there have been no serious accidents reported with passenger airliners.

The above statement was made in the European Commission on-line research magazine "Growth" dated 14th July 2000*.



* http://europa.eu.int/comm/research/growth/gcc/projects/in actionvortex.html

* Editorial remark

While this statement is true, there have been a number of fatal accidents involving smaller aircraft, and the example quoted bellow serves to demonstrate the power of wake vortices.

A number of research projects have been undertaken on both sides of the Atlantic ever since the problem of Wake Vortex Turbulence was identified. Indeed, the passage quoted above comes from an article which refers to the work done to date and emphasises the need for more research.

To quote again from "Growth":

The impetus for further study of wake vortices, now a major concern in North America as well as in Europe, is twofold:

1. A new generation of very large aircraft (VLA), such as the A380, is due to come into operation from 2007. These are expected to generate even larger wake vortices and if no action is taken will cause severe problems for ATM.

2. Many busy airports in the USA and Europe are already working near capacity limits, at least during peak hours. A better understanding of the wake-vortex phenomenon would permit aircraft to fly closer together when local weather conditions were suitable and so ease congestion. Increasing capacity in this way would be a better solution than building new runways.

A third potential area for concern is RVSM airspace, and several studies of wake vortex incidents have been carried out on behalf of EUROCONTROL. These indicate that the majority of wake vortex encounters occur with climbing or descending aircraft. It is too early to tell if the introduction of RVSM has had an impact on the probability of wake vortex encounter and so there is a continuing need to keep up the momentum of reporting so that any significant trends can be identified.

Finally, it has been observed that the wake vortex characteristics of certain aircraft types, particularly the Boeing 757, seem to differ from what would be expected based on their size. Because of this, some national authorities specify greater separation for aircraft following these aircraft types.

While there have been rare instances where wake turbulence caused structural damage, the greatest hazard is induced roll and yaw. This is especially dangerous during takeoff and landing when there is little altitude for recovery.

During takeoff and landing, the vortices sink toward the ground and move laterally away from the runway centreline, when the wind is calm. A 3kt—5kt crosswind will tend to keep the upwind vortex in the runway area and may cause the downwind vortex to drift toward another runway.

Minimum separation distances are specified in ICAO Doc 4444 (PANS-ATM). This may be supplemented by national regulations. The heavier the aircraft and the slower it is flying, the stronger the vortex.

Aircraft should be spaced so that aircraft of a lower weight category do not fly through the wake of aircraft of a higher category within the area of maximum vortices. Therefore, different separation distances are applied depending on the runway configuration (single, parallel, crossing or diverging runways) and the departure route being flown.

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Lessons Learned

WAKE VORTEX TURBULENCE - From several safety

occurrances we recommend:

- Departing aircraft must be separated by at least the minimum spacing specified in ICAO or national regulations.
- Arriving aircraft must be separated from preceding aircraft by at least the minimum spacing specified in ICAO or national regulations and must be routed so as to avoid the wake vortex turbulence from departing aircraft.
- In light or calm wind conditions, pilots of aircraft following other aircraft at near the minimum specified spacing should be warned that turbulent conditions may persist.
- Pilots of aircraft reporting wake vortex turbulence should be encouraged to submit a formal report using the standard Wake Vortex Reporting form.
- ATCOs controlling aircraft operating under VFR should remain alert to the danger of wake vortex turbulence and warn pilots if they approach the minimum recommended separation.