WIND SHEAR

1. Introduction

Wind shear is a sudden change of wind velocity and/or direction.

You can find these following types of wind shear:

- Vertical wind shear
- Horizontal wind shear

Vertical wind shear is vertical variation of the horizontal wind component resulting in turbulence and affecting aircraft airspeed (when crossing throught the shear layer).

Horizontal wind shear is horizontal variation of the wind component affecting the aircraft and resulting a decreasing head wind, an increasing tail wind or a shift from a head wind to a tail wind.

Wind shear is associated usually with the following weather conditions:

- Thunderstorm and convective clouds
- Mountain waves
- Frontal surfaces
- Jet streams
- Microbursts

Microburst can be:

- A downburst that results in strong vertical velocity downdrafts (reaching 40 knots)
- An outburst that results in strong horizontal wind shear and wind components (reaching 100 knots)

2. Recognition

You can detect a wind shear condition during approach and during go-around, based on analysis of aircraft flight parameters.

The following parameters are indication of a suspected wind shear condition:

- Indicated airspeed variations in excess of 15 knots
- Groundspeed variations
- Vertical-speed excursions of 500fpm or more
- Pitch attitude excursions of 5° or more
- Glideslope deviation of 1 dot or more
- Heading variations of 10° or more
- Unusual auto throttle activity or throttle lever position

In addition, some aircraft can provide a “wind shear” auditive warning.

Some weather radar can detect wind shear areas ahead of the aircraft and generate a shind shear warning (red “wind shear ahead”) and caution (amber “wind shear ahead”) or advisory alert messages.

3. Operating procedures

The following opportunities are available to enhance wind shear awareness and operating procedures.

- Approach briefing
- Approach hazards awareness
- Task sharing for effective cross-check
- Energy management during approach
- Stabilized approach and approach gate
- Commitment to respond to a wind shear warning
- Take-off and departure briefing
- Most recent weather reports and forecasts
- Visual observations
- Crew experience with the airport environment
- Delaying the takeoff until conditions improve
- Select minimum flaps configuration compatible with takeoff requirement to maximize climb-gradient capability
- Use of weather radar
- Select maximum takeoff thrust
- Monitor the airspeed during the takeoff roll to detect any evidence of impending wind shear

4. Wind shear recovery

If wind shear is encountered, the following actions should be taken without delay.

4.1. During take-off roll before V1

- The takeoff should be rejected in unacceptable airspeed variation occurs if there is sufficient runway remaining to stop the airplane.

4.2. During take-off roll after V1

- Disconnect the auto throttle (A/THR), if available, and
- Maintain or set the throttle levers to maximum takeoff thrust

4.3. During initial climb

- Disconnect the auto throttle (A/THR), if available, and set the throttle levers to maximum takeoff thrust

- If the autopilot (AP) is engaged and if the FD provides wind shear recovery guidance, keep the AP engaged or follow the FD pitch command, if the FD provides wind shear recovery guidance
- Level the wings to maximize the climb gradient, unless a turn is required for obstacle clearance
- Closely monitor the airspeed, airspeed trend and flight path angle
- Do not change the flaps or landing gear configurations until out of the wind shear conditions

When out of the wind shear conditions, increase airspeed when a positive climb rate is confirmed, retract the landing gear and flaps. Then establish a normal climb profile.

4.4. During approach and landing

- Select the TOGA mode and set and maintain maximum go-around thrust
- Follow the FD pitch command
- If the AP is engaged and if the FD provides wind shear recovery guidance, keep the AP engaged. Otherwise, disconnect the AP and set the recommended pitch attitude
- Do not change the flap configuration or landing gear configuration until out of the wind shear
- Level the wings to maximize the climb gradient, unless a turn is required for obstacle clearance
- Allow airspeed to decrease to stick-shaker onset
- Closely monitor the airspeed, airspeed trend and flight path angle

When out of the wind shear conditions, increase airspeed when a positive climb rate is confirmed, retract the landing gear and flaps. Then establish a normal climb profile.

5. Conclusion

Be alert for wind shear conditions, based on all available weather data, on-board equipment and aircraft flight parameters and flight path.

Monitor the instrument for evidence of impending wind shear

Be prepared and committed to respond immediately to a wind shear warning

Consider delaying the approach or diverting to a more suitable airport

Avoid large thrust variations or trim changes in response to sudden airspeed variations