Onboard windshear warning systems

A microburst is a weather pattern that can create windshear. This condition has been linked to commercial plane crashes, especially during takeoffs and landings. Researchers feel that a 15- to 40-second warning will allow pilots to deal with this hazard. NASA Langley and the FAA are working on a variety of airborne detection and early warning systems. They include onboard microwave radar, infrared and LIDAR systems.

1. During a landing a plane entering a microburst encounters head winds that increase airspeed. To maintain airspeed and rate of descent the pilot will normally reduce power.
2. The plane flies through the headwind and encounters a downdraft followed by a tailwind. These rapidly reduce airspeed and climb potential and, because of the earlier cut in power, can cause the plane to crash.

Microwave radar

Microwave radar emits radio waves at a uniform frequency and wavelength that are reflected back by raindrops. The returning signals' frequency is measured and compared with the emitted frequency to determine the direction and speed of the raindrops. A Doppler reading of varying wavelengths can indicate a windshear condition.

A
The raindrops borne by headwinds return a shorter wavelength.

B
The raindrops borne by tailwinds return a longer wavelength.

Infrared

A small, relatively inexpensive system used to measure infrared radiation, which we feel as heat. A sensor measures the changes in temperature in front of a plane. These changes can be an indication of wind gusts. The sensor would activate a warning light in the cockpit.

LIDAR

LIDAR, short for Light Detecting and Ranging, uses light waves in the form of a laser beam much like Doppler radar uses radio waves. Instead of measuring the speed of raindrops, it measures the speed of aerosols and dust particles in the atmosphere to detect changes in the wind.