How dangerous is wind shear in aviation?

Wind shear is a sudden and unexpected change of wind direction and velocity (speed) over a short distance. It can be vertical, horizontal or a mixture of both types and usually is associated with thunderstorm activity and severe turbulence. In general, wind shear doesn't present a great threat to the aircraft. But wind shear becomes dangerous when it negatively affects aircraft performance. The aircraft may lose speed, lifting power and altitude. So pilots will experience significant difficulties in controlling aircraft during takeoff and landing and what is more they can lose total control of the flight. It can lead to disaster.

- ***At what stages of flight does wind shear affect an aircraft most?***

Wind shear is particular dangerous to aircraft during approach, landing and initial climb phase. At these stages of flight the crew is limited in altitude and time to make correct maneuvers/actions.

- ***What are possible results of wind shear?***

Due to wind shear pilots may experience unstable approach or deviate from the Glide Slope/Path, STARS and SID. Separation with other aircraft in the area may be reduced. To avoid conflicts controllers will apply orbit, holding and other procedures. Besides in case of hard landing the crew and passengers may receive injuries, they will need evacuation and medical assistance. What is more the aircraft may block the RW and airport operations will be stopped. To solve problems with delays and traffic congestion controllers will reroute aircraft to alternates. It's an additional/extra workload for controllers.

- ***What may happen to an aircraft experiencing severe wind shear ?***

If an aircraft enters wind shear area it may overshoot or undershoot the RW. In case of undershoot the aircraft may hit the RW and catch fire. In case of overshoot the aircraft may run off or skid off the RW and collide with obstacles. As a result the aircraft may receive bad/serious damage to landing gears, wings, a tail, propellers or engines (may be damaged badly). And finally it may crash.

- ***Are wind shear and turbulence similar?***

Wind shear and turbulence are different weather phenomena but still similar a little bit . Both phenomena are associated (connected) with jet steams, thunderstorms, rainfalls, microburst and so on. Besides consequences from turbulence and wind shear for aircraft and passengers may be same. I mean structural damage to aircraft and injuries to passengers.

- ***Is it possible to predict wind shear?***

All modern aircraft are equipped with on board wind shear detection and alerting systems (Airborne Wind Shear Detection System). An alarm sounds in the cockpit. They use radar and other technologies to process weather data. The pilot assesses the situation and as a rule he makes decision not to enter the dangerous area but to avoid it. Also some airports have ground based Low Level Wind Shear Alert System. It provides a warning in the ATC Tower if hazardous wind shear is detected.

- ***What actions can controllers expect from the flight crew when they encounter wind shear?***

Pilots actions will depend on the level/extent of wind shear: light, moderate or severe. So in accordance with it during approach, landing the crew may make decision to go around or continue approach and choose the most suitable RW. Takeoff may be rejected or continued.

- ***What are controller's actions when they receive pilot's information about wind shear?***

In such a case a controller must request (know) pilot's decision and act upon it: to provide the pilot with all the necessary information and aids. Also the controller must inform all aircraft in his area and meteorological office.

- ***What measures should be taken to reduce wind shear influence in aviation?***

First of all, it's necessary to improve wind shear forecasting. Then to organize more training for pilots to deal with wind shear (to recognize and avoid it timely and correctly). Also to use more sophisticated ground and airborne wind shear warning systems.

- ***Have you ever had/heard of a situation connected with wind shear?***

As for me personally, I have never had such examples in my experience. But wind shear is an often phenomenon in our area because we have quite a deep trench and two rivers in the vicinity of our aerodrome. So, from time to time we receive wind shear reports from pilots during approach. As a rule, they inform of going around for another hand approach and then perform a safe landing. So it's not a big problem for us.