Flight Emergencies and Hazards

The Pilot/Controller Glossary divides emergencies into two categories: distress and urgency. Distress is a condition of being threatened by serious and/or imminent danger and of requiring immediate assistance. Distress conditions include fire, mechanical failure or structural damage. An urgency condition is one of being concerned about safety and of requiring timely but not immediate assistance. At least an urgency condition exists the moment a pilot becomes doubtful about position, fuel endurance, weather or any other condition that could adversely affect the safety of flight. A pilot should declare an emergency when either an urgency or a distress condition exists.

When a distress or urgency condition exists, the pilot should set the radar beacon transponder to code 7700. If an aircraft is being hijacked or illegally interfered with, the pilot can alert ATC to that fact by setting the transponder to code 7500. If an aircraft has experienced a two-way communications radio failure, the pilot should set the transponder to code 7600. The pilot should also conform to the radio failure procedures of 14 CFR §91.185 (IFR operations: Two-way radio communications failure). In order to avoid false alarms, pilots should take care not to inadvertently switch through codes 7500, 7600 and 7700 when changing the transponder.

If a two-way radio failure occurs in VFR conditions, or if VFR conditions are encountered after the failure, the pilot must continue the flight under VFR and land as soon as practicable. If IFR conditions prevail, the pilot must follow the rules listed below for route, altitude and time to leave a clearance limit:

Route to be Flown

- The route assigned in the last ATC clearance received.
- If being radar vectored, fly by the direct route from the point of the radio failure to the fix, route or airway specified in the vector clearance.
- In the absence of an assigned route, fly by the route that ATC has advised may be expected in a further clearance.
- In the absence of an assigned route or expected further routing, fly by the route filed in the flight plan.

Altitude

Fly the highest of the following altitudes or flight levels for the route segment being flown:

- The altitude or flight level assigned in the last ATC clearance received.
- The minimum IFR altitude for the route segment being flown (MEA).
- The altitude or flight level that ATC has advised may be expected in a further clearance.

When to Leave a Clearance Limit

- When the clearance limit is a fix from which an approach begins, commence descent or descent and approach as close as possible to the expect further clearance (EFC) time if one has been received; or if one has not been received, as close as possible to the estimated time of arrival (ETA) as calculated from the filed or amended estimated time en route.
- If the clearance limit is not a fix from which an approach begins, leave the clearance limit at the expect further clearance (EFC) time if one has been received; or if none has been received, upon arrival over the clearance limit, and proceed to a fix from which an approach begins and commence descent or descent and approach as close as possible to the estimated time of arrival (ETA) as calculated from the filed or amended time en route.

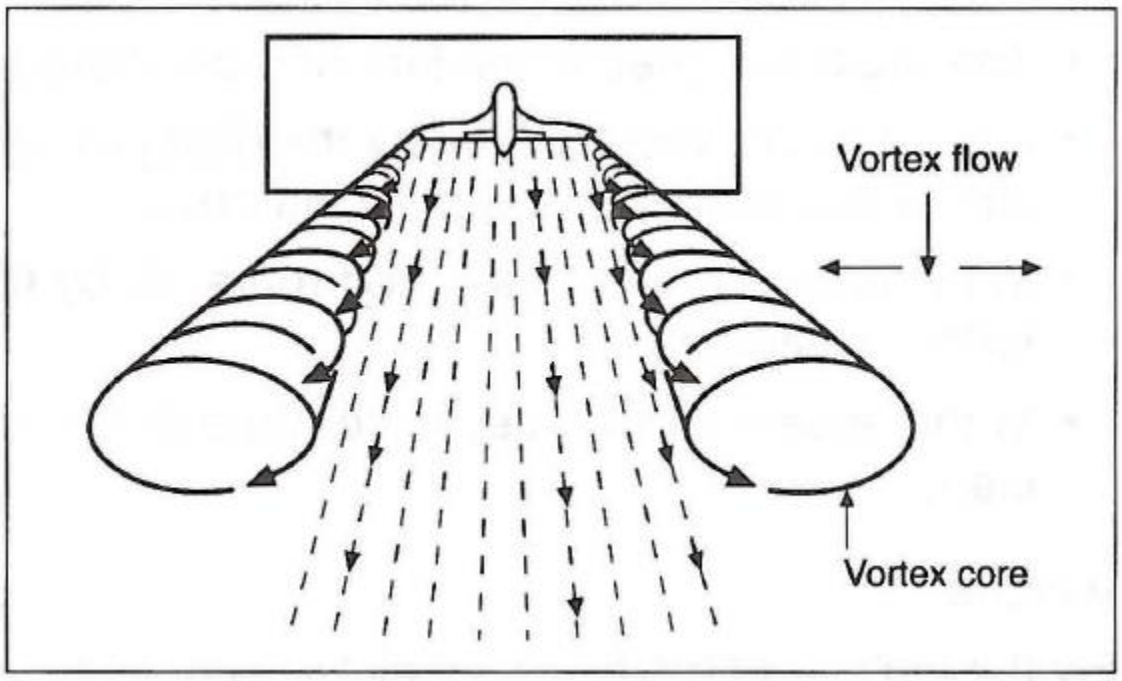
A near midair collision is defined as an occurrence in which the possibility of a collision existed as the result of two aircraft coming within 500 feet or less of each other.

A minimum fuel advisory is used by a pilot to inform ATC that the fuel supply has reached a state where the pilot cannot accept any undue delay upon arrival at the destination. The minimum fuel advisory is not a declaration of an emergency, nor is it a request for priority. It does indicate that an emergency situation may develop if any undue delay occurs during the rest of the flight.

Some airports have a number of wind indicators located around the perimeter of the field as well as a center field windsock. When there is a significant difference in speed or direction between the center field windsock and one or more of the boundary wind indicators, the tower can report that a wind shear condition exists.

A safety alert will be issued to pilots being controlled by ATC in either of two circumstances. A controller will issue a safety alert when, in the controller's opinion, the aircraft's altitude will put it in unsafe proximity to the surface or an obstacle. A controller will also issue an alert if he/she becomes aware of another aircraft, not controlled by him/her, that will put both aircraft in an unsafe proximity to each other.

The **wake turbulence** developed by large aircraft can present a significant flight hazard to other aircraft that encounter them. The main component of wake turbulence is **wing-tip vortices.** These are twin vortices of air trailing behind an aircraft in flight. The **vortex** is a by-product of lift. The pressure under each wing is greater than the pressure above it and this induces a flow of air outward, upward and around the wing tip. This leaves two counter-rotating spirals of air trailing behind the aircraft. *See* Figure 7-1.

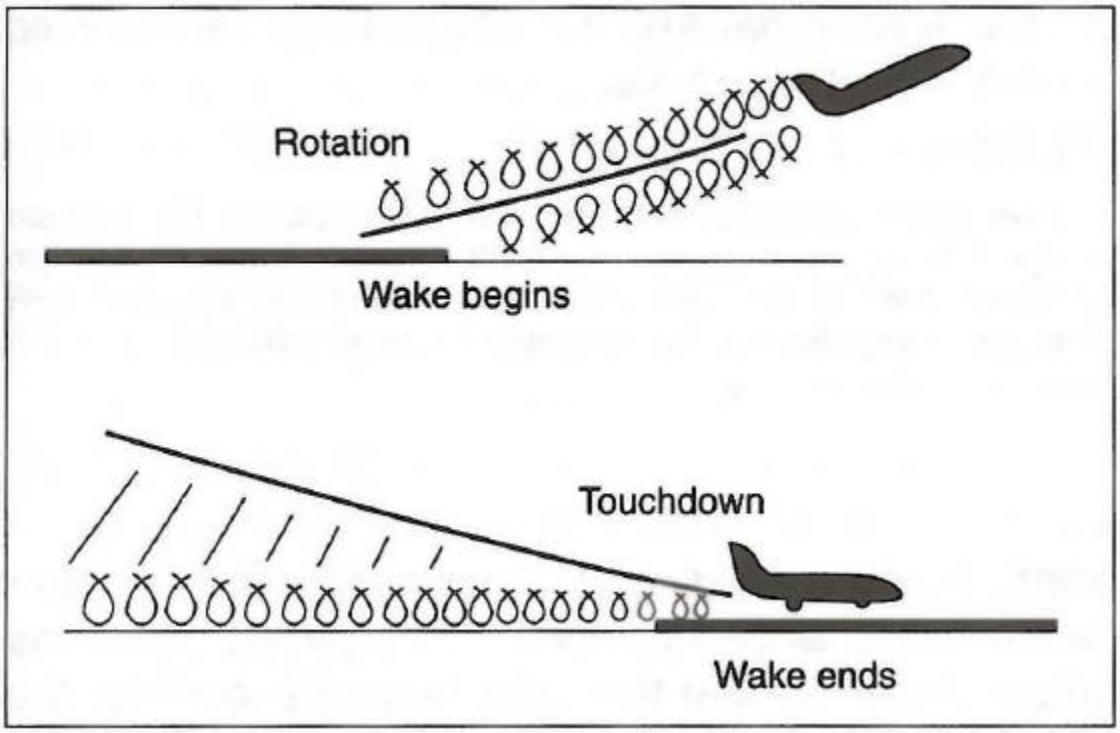


The characteristics of a vortex can be altered by changing the aircraft's configuration. The most intense vortices will be produced by an airplane that is heavy, flying slowly, and with the landing gear and flaps retracted.

The vortices generated by a large aircraft will slowly sink below its flight path and dissipate by the time they have descended about 1,000 feet. They will also tend to drift away from each other at a speed of about five knots. In a light crosswind, the upwind vortex will tend to stay over the same position on the ground while the downwind vortex will move away at about twice its normal rate. It is good wake turbulence avoidance technique to stay above and on the upwind side of the flight path of a preceding large airplane.

If the vortices reach the ground before dissipating, they will move away from each other as noted above. In a light crosswind, the upwind vortex can remain on the runway long after a large airplane has taken off or landed. The most hazardous situation is a light quartering tailwind, which not only keeps a vortex on the runway but also inhibits its dissipation.

If you plan to take off behind a large airplane, try to rotate prior to that airplane's point of rotation and climb out above and on the upwind side of the other airplane's flight path. If you plan to takeoff from a runway on which a large airplane has just landed, try to plan your lift-off point to be beyond the point where that aircraft touched down. *See* Figure 7-2.



Flight Physiology

Even small amounts of alcohol have an adverse effect on reaction and judgment. This effect is magnified as altitude increases. No one may serve as a crewmember on a civil aircraft:

- Within 8 hours of the consumption of any alcoholic beverage.
- While having a blood alcohol level of .04% or higher.

Runway width illusion—A runway that is narrower than usual can create the illusion that the aircraft is higher than it really is. This can cause an unwary pilot to descend too low on approach. A wide runway creates an illusion of being too low on glide slope.

Featureless terrain illusion—An absence of ground feature, as when landing over water, darkened areas and terrain made featureless by snow can create the illusion that the aircraft is higher than it really is.

Autokinesis—In the dark, a static light will appear to move about when stared at for a period of time.

An effective scan pattern is necessary to ensure that a pilot will see other aircraft in time to avoid potential midair collisions. This means that 2/3 to 3/4 of a pilot's time should be spent scanning outside the aircraft. The best method would be to look outside for about 15 seconds and then inside for about 5 seconds. It is much easier to see an aircraft which is moving relative to the observer. Unfortunately, aircraft which present a collision hazard are usually on the horizon with little or no apparent horizontal or vertical movement. The image only grows larger as the threat aircraft gets closer. Special vigilance must be exercised for this type of situation. A pilot's most acute night vision is off-center in his/her peripheral vision. When looking for other aircraft at night, scan slowly to allow sufficient time for this off-center viewing.

All pilots who fly in instrument conditions or at night are subject to spatial disorientation. This occurs when body sensations are used to interpret flight attitudes, and there is no visual reference to the horizon. The only reliable way to overcome this disorientation is to rely entirely on the indications of the flight instruments. Some types of vertigo include:

The leans—An abrupt correction of a banked angle can create the illusion of banking in the opposite direction.

Coriolis illusion—An abrupt head movement during a constant rate turn can create the illusion of rotation in an entirely different axis. This illusion can be overwhelming and so rapid head movements in turns should be avoided.

Inversion illusion—An abrupt change from a climb to straight and level flight can create the illusion of tumbling backwards.

Somatogravic illusion—A rapid acceleration during takeoff can create the illusion of being in a nose up attitude.

Hypoxia is caused by insufficient oxygen reaching the brain. The most usual reason is the low partial pressure of oxygen encountered at altitude. Carbon monoxide poisoning is similar to hypoxia in that it causes too little oxygen to reach the brain. Carbon monoxide (usually from an exhaust leak) binds with the hemoglobin in the blood, preventing its usual oxygen-carrying function. The symptoms of both are similar and include dizziness, tingling of the hands, feet and legs, loss of higher thought processes, and unconsciousness. The sufferer may not notice or react to any of the symptoms due to his degraded mental faculties. Hyperventilation is caused by a reduction of carbon dioxide in the

blood, usually due to rapid breathing in a stressful situation. The symptoms of hyperventilation are similar to hypoxia, but recovery is rapid once the rate of breathing is brought under control.