

LOAD LIMITS IN AIRCRAFT DESIGN



LOAD LIMITS - PROTECTING PILOTS AND PLANES

Demonstrate your understanding of load limits and aircraft design by answering the following questions.

1. What are G-forces and how are they created?

G-force is defined as an accelerating force that causes an accelerating body to be subjected to a force opposite to the acceleration. They are created when the inertia of a body is acted upon by an outside force like speeding up or slowing down the body's movement or causing it move in a new direction. The greater the change, the more powerful the G-forces.

2. What kinds of maneuvers might increase the G-forces experienced by an aircraft and its occupants?

Maneuvers that result in quick or dramatic changes of direction or speed could increase load factors. These include steep banked turns, aerobatic maneuvers, and climbs or dives.

3. Why must an aircraft be designed to withstand forces greater than 1 G?

One G is the force an aircraft experiences sitting on the ground or in level flight in smooth air. Aircraft must be designed to withstand additional forces because they must be able to maneuver (change direction) quickly and operate in turbulent air, both of which impose additional forces on the aircraft.



4. What happens to the human body under high Gs?

Blood can be pulled from the head and torso toward the feet. This can make it difficult to think and to breathe. A person can experience vision problems (gray out) or lose consciousness (G-LOC). A person will also feel much heavier than they normally do.

5. What characteristics are important in choosing materials for building aircraft?

Aircraft materials must be light and strong. They should also be flexible to allow the aircraft to respond to changing forces without breaking.

6. Why do manufacturers build aircraft to exceed design limits? Can pilots use the extra margin of safety to fly beyond the specified operational limits? Why or why not?

Manufacturers build aircraft that meet or exceed the minimum load factor requirements for a specific category. As a rule, manufacturers overdesign aircraft to provide a safety margin of at least 50 percent. This 1.5 value is called the “factor of safety” and provides, to some extent, for loads higher than those expected under normal and reasonable operation. The test represents 150 percent of the most extreme forces the aircraft is expected to encounter.

However, this does NOT mean a pilot can exceed the load limit factor identified in the aircraft's handbook. If a pilot exceeds the limit by up to 50 percent, parts of the aircraft may twist or bend, but the pilot and the occupants will likely survive.