

## What happens when a plane suffers a hydraulic failure?

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Recently, an Air India Express aircraft was diverted to Thiruvananthapuram after a suspected hydraulic failure.

- The tail portion of the aircraft had struck the runway during takeoff.



[Ref: businesstoday]

### About aircraft's movable surfaces:

- The ailerons, elevators, and rudder are **critical flight control surfaces**.
- **Ailerons:** It is called '**little wing**' or '**fin**' in French, which are located on the wing's trailing edge and near the wingtip.
  - Pilot can control their up and down movement.
- **Elevators:** They're mounted on an aircraft's tail.
  - Pilot can control aircraft's pitch by their up and down movement.
  - They raise or lower its nose to climb or descend, by moving the elevators.
- **Rudder:** The vertical fin mounted on the aircraft's tail, moves left or right.
  - Pilots control an aircraft's yaw, or right or left movement, by moving the rudder.
  - On the ground too, to get directional control, while rolling down the runway for takeoff or after touching down.
- Pilot can't steer the plane through the **air, bank, climb, or descend** without controlling Ailerons, Elevators and Rudder.

### About hydraulic systems in aircraft:

- The ailerons, elevators, and rudder are all moved by **hydraulics in bigger and heavy jets**.
- **Hydraulics are used for other critical movements such as-**
  - The extension or retraction of the aircraft's landing gear.
  - The movement of the flaps and slats.
    - They are **mounted on the wings' trailing and leading edges** and are extended during takeoff and landing to increase 'lift'.

- The movement of the spoilers.
  - They are mounted on **top of the wings** and are deployed to slow an aircraft.
- Activating the wheel brakes, thrust reversers, and horizontal stabilizer
  - It is the **small wing-like structure on an aircraft's tail** on which the elevators are mounted.

### Working of aircraft hydraulics

- A pilot controls the **movement of the ailerons, elevators, and rudder** by moving the sidestick/yoke and rudder pedals in the flight deck.
  - The force of a pilot's physical inputs cannot move the huge and heavy movable surfaces and components.
  - The ailerons on a big jet are huge and quite heavy, and on top of this, air pressure acts on them during flight.
- Aircraft's hydraulic system **uses pressurized fluid to magnify the pilot's physical inputs**, and then transfers the '**magnified force**' to actuators, which move the control surfaces.
- The control surfaces are **moved by actuators driven by hydraulic fluids**, even when aircraft is being hand-flown or it is on autopilot.
- Small aircrafts either **don't have hydraulically-operated control surfaces** or have partial or limited hydraulics, meaning only one or two components are driven by hydraulics.
  - Whereas, all big passenger jets have **hydraulically-operated control surfaces and components**.

### Failure of aircraft's hydraulics

- There can be loss of pressure of the fluid due to a **leak, overheating, a faulty or old component breaking down, or physical damage** to the hydraulic lines.
- Modern planes have **multiple hydraulic systems**, if one fails, there is always a backup to fall back on.
  - It is unlikely that all the systems will fail at the same time.
- Some aircraft systems can be **operated manually**.
  - For example, in the event of hydraulic failure, the **landing gear can be extended manually using an alternative system** that allows it to drop down under the force of gravity.
- In case of failure warning, depending on the **pilot's assessment of the situation** and what backup hydraulics are available, aircraft often divert to the **nearest airport and land as quickly as possible** for the sake of safety and passenger comfort.
- There have been incidents when **leaking hydraulic fumes** have entered the aircraft cabin, requiring evacuation.