

## Topic 5 – Hydraulics and Pneumatics

**Hydraulic systems** use the force of a liquid in a confined space.

Hydraulic systems apply two essential characteristics of fluids – their incompressibility and their ability to transmit pressure.

**Pneumatic systems** do not seal the gas (usually air) in the same way as hydraulic systems seal in the fluid it uses. The air usually passes through the pneumatic device under high pressure and then escapes outside the device. The high pressure air is used to do the work.

### Pneumatics at Work



The *jackhammer* is an example of a pneumatic device that is used to do work. The loud noise of the jackhammer is the compressed air at work. Bursts of air, under very high pressure drive the '*chuck*' in and out of the jackhammer at high speeds, which pounds the concrete – breaking it up into small rocks or fragments.



Staple guns and pneumatic nailers use pulses of air pressure to drive staples or nails into solid objects.



Sandblasters do exactly what the name implies. High pressure air blasts tiny sand particles out of a nozzle to remove dirt and paint from stone or rock. Sandblasting an old building made of stone or brick can make it look almost like new. Sandblasting is also used to roughen surfaces to improve traction, by increasing friction. Medical engineers have developed a type of cast filled with pressurized air, which makes it fit snugly and securely.

### Riding on Air



Hovercrafts are used by the Canadian Coast Guard in search and rescue missions. They are also used commercially, to transport people, cars and equipment over long distances on land or water. The hovercraft has a pump that draws air from outside and pumps it out through small holes in the bottom of the hovercraft. A skirt around the bottom holds enough air to support the weight of the craft above the water or land. Propellers on the back of the craft drive the hovercraft forward, and rudders are used to steer it.

### Hydraulics at Work

Most machines that move very large, very heavy objects use a hydraulic system that applies force to levers, gears or pulleys. A **hydraulic system** uses a liquid under pressure to move loads. It is able to increase the mechanical advantage of the levers in the machine. Modern construction projects use hydraulic equipment because the work can be done quicker and safer. There are many practical applications of hydraulic systems that perform tasks, making work much easier.

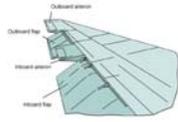


*Earthmovers* use hydraulics to move large amounts of dirt from place to place.



The *cherry picker* is an example of a hydraulic device that is used to do raise workers to high places to repair or do work at heights that normally could not be reached safely.

## Hydraulics in Flight



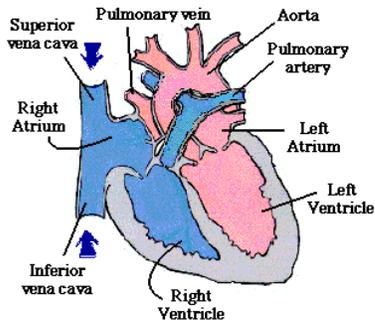
The various parts of an airplane wing are raised and lowered hydraulically. Hydraulics are also responsible for tail adjustments to enable the pilot to turn the plane in the air. Wheels are raised and lowered using a hydraulic system as well. There are different hydraulic systems in different aircraft, but all the systems work together in much the same way to provide reliable and safe adjustments when the plane is taking off, airborne and landing.

## Hydraulics and Pneumatics in Your Body

Life depends on a pneumatic system in your body – namely the respiratory system. The lungs that allow air to enter and leave the body as they contract and expand. Breathing depends on changes in air pressure. You breathe in and out about 12 times a minute, exchanging about 500ml of air each time.

Your body also depends on a complex hydraulic system – the circulatory system. The heart (your hydraulic device) pumps the blood (fluid) around your body carrying food and nutrients to all cells in your body. A review of this body system ([Unit 2 – Topic 6 – Cells and Systems](#)) will help you understand the details.

## Valves and Pumps



A valve is used to control the flow of a fluid. It is a moveable part that controls the flow by opening or closing. Many pumps use automatic valves controlled by pressure to move fluids in specific directions. Pressure on one side opens the valve and closes when the pressure on the other side is greater.

The heart is actually two pumps that circulate your blood throughout the body. Four automatic valves are used to help circulate the blood. Between heartbeats the pressure changes allowing the valves to open and close when they are supposed to.