Airplanes Essay, Research Paper

One of the first things that is likely to be noticed

during a visit to the local airport is the wide variety of

airplane styles and designs. Although, at first glance, it

may be seen that airplanes look quite different from one

another, in the long run their major components are quite

similar. These similarities lie in the fuselage, wing,

empennage, landing gear, and powerplant. The four forces of

flight which all planes have in common are lift, weight,

thrust, and drag.

The fuselage serves several functions. Besides being a

common attachment point for the other major components, it

houses the cabin, or cockpit, which contains seats for the

occupants and the controls for the airplane. The fuselage

usually has a small baggage compartment and may include

additional seats for passengers.

When air flows around the wings of an airplane, it

generates a force called “lift” that helps the airplane fly.

Wings are contoured to take maximum advantage of this force.

Wings may be attached at the top, middle, or lower portion of

the fuselage. These designs are referred to as high-, mid-,

and low-wing, respectively. The number of wings can also

vary. Airplanes with a single set of wings are referred to

as monoplanes, while those with two sets are called biplanes.

To help fly the airplane, the wings have two types of

control surfaces attached to the rear, or trailing, edges.

They are referred to as ailerons and flaps. Ailerons extend

from about the midpoint of each wing outward to the tip.

They move in opposite directions – when one aileron goes up,

the other goes down. Flaps extend outward from the fuselage

to the midpoint of each wing. They always move in the same

direction. If one flap is down, the other one is also down.

The empennage consists of the vertical stabilizer, or

fin, and the horizontal stabilizer. These two surfaces are

stationary and act like the feathers on an arrow to steady

the airplane and help maintain a straight path through the

air.

The rudder is attached to the back of the vertical

stabilizer. Used to move the airplane’s nose left and right.

Actually, using the rudder and ailerons in combination during

flight to initiate a turn.

The elevator is attached to the back of the horizontal

stabilizer. During flight it is used to move the nose up and

down to direct the airplane to the desired altitude, or

height.

Most airplanes have a small, hinged section at the back

of the elevator called a trim tab. Its purpose is to relieve

the pressure it must be held on the control wheel to keep the

nose in the desired position. In most small airplanes, the

trim tab is controlled with a wheel or a crank in the

cockpit.

Some empennage designs vary from the type of horizontal

stabilizer. They have a one-piece horizontal stabilizer that

pivots up and down from a central hinge point. This type of

design, called a stabilator, requires no elevator. Move the

stabilator using the control wheel, just as in an elevator.

When you pull back, the nose moves up; when you push forward,

the nose moves down. An antiservo tab is mounted at the back

of the stabilator, to provide a control “feel” similar to

what you experience with an elevator. Without the antiservo

tab, control forces from the stabilator would be so light

that it might might be “over controlled” the airplane or move

the control wheel too far to obtain the desired result. The

antiservo tab also functions as a trim tab.

The landing gear absorbs landing loads and supports the

airplane on the ground. It typically is made up of three

wheels. The two main wheels are located on either side of

the fuselage. The third may be positioned either at the nose

or at the tail. If it is located at the tail, it is called a

tailwheel. In this case, the airplane is said to have

conventional landing gear.

Conventional gear is common on older airplanes, as well

as on some newer ones. It is desirable for operations on

unimproved fields, because of the added clearance amid the

propeller and the ground. However, airplanes with this type

of gear are more difficult to handle during ground

operations.

When the third wheel is located on the nose, it is

called a nosewheel. This design is referred to as tricycle

gear. An airplane with this type of gear has a steerable

nosewheel, which you control through use of the rudder

pedals.

Landing gear can also be classified as either fixed or

retractable. Fixed gear always remains extended, while

retractable gear can be stowed for flight to reduce air

resistance and increase airplane performance.

Just as shock absorbers are needed on a car, some shock

absorbing device is needed on the landing gear. Shock struts

are designed for this purpose. They absorb bumps and jolts,

as well as the downward force of landing.

Airplane brakes operate on the same principles as

automobile brakes, but they do have a few significant

differences. For example, airplane brakes usually are

located on the main wheels, and are applied by separate

pedals. Because of this, operating the brake on the left

independently of the brake on the right, or vice versa is

possible. This capability is referred to as differential

braking. It is important during ground operations when you

need to supplement nosewheel steering by applying the brakes

on the side toward the direction of turn. In fact,

differential braking is extremely important on conventional

gear airplanes, since some do not have a steerable wheel.

In small airplanes, the powerplant includes both the

engine and the propeller. The primary function of the engine

is to provide the power to turn the propeller. It also

generates electrical power, provides a vacuum source for some

flight instruments, and, in most single-engine airplanes,

provides a source of heat for the pilot and passengers. A

firewall is located between the engine compartment and the

cockpit to protect the occupants. The firewall also serves

as a mounting point for the engine.

During flight, the four forces acting on the airplane

are lift, weight, thrust, and drag. Lift is the upward force

created by the effect of airflow as it passes over and under

the wings. It supports the airplane in flight. Weight

opposes lift. It is caused by the downward pull of gravity.

Thrust is the forward force which propels the airplane

through the air. It varies with the amount of engine power

being used. Opposing thrust is drag, which is a backward, or

retarding, force that limits the speed of the airplane.

Lift is the key aerodynamic force. It is the force that

opposes weight. In straight-and-level, unaccelerated flight,

when weight and lift are equal, an airplane is in a state of

equilibrium. If the other aerodynamic factors remain

constant, that airplane neither gains nor loses altitude.

When an airplane is stationary on the ramp, it is also

in equilibrium, but the aerodynamic forces are not a factor.

In calm wind conditions, the atmosphere exerts equal pressure

on the upper and lower surfaces of the wing. Movement of air

about the airplane, particularly the wing, is necessary

before the aerodynamic force of lift becomes effective.

During flight, however, pressures on the upper and lower

surfaces of the wing are not the same. Although several

factors contribute to this difference, the shape of the wing

is the principal one. The wing is designed to divide the

airflow into areas of high pressure below the wing and areas

of comparatively lower pressure above the wing. This

pressure differential, which is created by movement of air

about the wing, is the primary source of lift.

The weight of the airplane is not a constant. It varies

with the equipment installed, passengers, cargo, and fuel

load. During the course of a flight, the total weight of the

airplane decreases as fuel is consumed. Additional weight

reduction may also occur during some specialized flight

activities, such as crop dusting, fire fighting, or sky

diving flights. In contrast, the direction in which the

force of weight acts is constant. It always acts straight

down toward the center of the earth.

Thrust is the forward-acting force which opposes drag

and propels the airplane. In most airplanes, this force is

provided when the engine turns the propeller. Each propeller

blade is cambered like the airfoil shape of a wing. This

shape, plus the angle of attack of the blades, produces

reduced pressure in front of the propeller and increased

pressure behind it. As is the case with the wing, this

produces a reaction force in the direction of the lesser

pressure. This is how a propeller produces thrust, the force

which moves the airplane forward.

To increase thrust by using the throttle to increase

power, thrust exceeds drag, causing the airplane to

accelerate. This acceleration, however, is accompanied by a

corresponding increase in drag. The airplane continues to

accelerate only while the force of thrust exceeds the force

of drag. When drag again equals thrust, the airplane ceases

to accelerate and maintains a constant airspeed. However,

the new airspeed is higher than the previous one.

When the thrust is reduced thrust, the force of drag

causes the airplane to decelerate. But as the airplane

slows, drag diminishes. When drag has decreased enough to

equal thrust, the airplane no longer decelerates. Once

again, it maintains a constant airspeed. Now, however, it is

slower than the one previously flown.

As it has been seen, drag is associated with lift. It

is caused by any aircraft surface that deflects or interferes

with the smooth airflow around the airplane. A highly

cambered, large surface area wing creates more drag (and

lift) than a small, moderately cambered wing. If the

airspeed is increased, or angle of attack, the drag and lift

increases. Drag acts in opposition to the direction of

flight, opposes the forward-acting force of thrust, and

limits the forward speed of the airplane. Drag is broadly

classified as either parasite or induced.

In conclusion, the basic construction of planes are

really quite similar and all planes need the four forces of

flight so that they are able to fly. These things are quite

unique in their own way but without these things the planes

would never be able to fly or even be built.