

Aircraft Design
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Lecture - 21
Aircraft Demonstration

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So this is an old aircraft piper super cub pa 18 dash 150. You can see the fuselage this is the thrust type fuselage which has got various tubular members. These tubular members they can carry both the tension and the compression loads these are the longitudinal members called the longerons then there are some florence these are also longitudinal members, but lighter and weight than the longerons called strangers strangers are numerous in number, longerons they are lesser in number.

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The aircraft components are composed of various parts called structural members that is strainers, longerons, ribs, bulk heads etcetera.

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The fuselage is the main structure or body of the aircraft, it provides space for cargo controls accessories passengers and other equipment and single engine aircraft it also houses the power plant. In multi engine aircrafts the engines may either be in the fuselage attached to the fuselage or suspended from the wing structure there are generally two types of fuselage construction.

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The thrust type and the monocoque type a thrust is a rigid frame work made up of members such as beams struts and bolts to resist deformation by applied loads. The thrust framed fuselage is generally covered with fabric the thrust type fuselage frame is usually constructed of steel tubings welded together in such a manner that all members of the thrust can carry both tension and compression loads.

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Nowadays most of the aircrafts are made of semi monocoque construction the semi monocoque fuselage is constructed primarily of the alloys of aluminum and magnesium all though steel and titanium are also found in areas of high temperatures.

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Primary bending loads are taken by the longerons which usually extend from across several points of support. The longerons are supplemented by other longitudinal members called strainers, strainers are lighter and weight than longerons and are more in number.

The vertical structural members also called as bulk heads or frames or farmers. The heaviest of these vertical members are located at various intervals to carry concentrated loads and at points where fittings are used to attach other units such as wings, power plants, stabilizers.

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The strainers are smaller and lighter than longerons and they serve as (Refer Time: 03:38). The strong heavy longerons hold the bulk heads and frames and these in turn hold the strainers. Strainers and longerons prevent tension and compression from bending the fuselage strainers are usually of a one piece aluminum alloy construction and are manufactured in a variety of shapes by casting extrusions or forming. Longerons like strainers are usually made of aluminum alloy.

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This is Cessna 206 dash h aircraft which is the single piston engine aircraft with the semi monocoque construction. The aircraft has got three sections the forward section which is from the front to this firewall this is the forward section you can see then that is the center section from the firewall to the end of the cable and then that is the tail cone section from here till the end.

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So this is another wing configuration you can see the high wing this is Cessna 206 aircraft.

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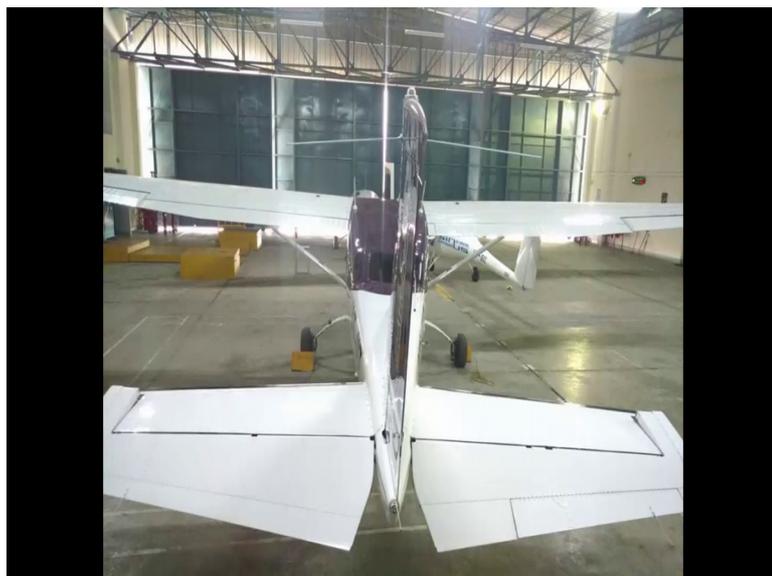
See the location of the wing it is in the high wing position this aircraft consist of formed bulk heads longitudinal stringers reinforcing channels and skin. The principal material is 2024 alclad aluminium alloy which after forming is heat treated to 2024 t 42 condition and sprinted with corrosion resistant primer.

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All bulk heads in this fuselage are constructed of formed sheet metal or reinforced sheet metal.

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The frame members of the cable section are consist constructed of formed bulk head channels bulk heads are formed u channel sections. The construction consist of formed bulk heads longitudinal strangers reinforcing channels and skin and this aircraft.

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You can see the wings they are of all metal construction with a strut basing they are semi monocoque construction and utilize tools parts.

Each wing consist of an outer wing panel within integral fuel bay and aileron and the flap flanged upper and lower edges of all the ribs serve as cabs ribs in addition to providing rigidity to the rib. The skin is riveted directly to each rib flange and provides the cellular strength for each successive rib bay. The lowes center and trailing edge rib segments are riveted together to the front and rears parts to form basic air foil sections. The strangers which are made of alclad stiffen thus can between the ribs sparse are comprised of machine milled tapered exclusions riveted to sheet metal webs.

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So on this Cessna 206 h aircraft the wing as of metal construction was semi can deliver semi monocoque type which just what two mains parts this is the fronts par, the mains par, you can see the riveted line this is the your mains par going through, the through and through. Then this rear line riveting line is the rears par skin panels are riveted to ribs ribs you can see here the aircraft the wing has got different ribs the riveted lines this is the first rib, the second rib, the third rib, the fourth rib, you can see the riveted line this is the rib the skin panels are riveted to ribs spars and strangers to complete the structure ok.

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Now, see the internal structure of the wing this is the fronts par the fronts par you can see from inside the wing on the left side is the rib you can see the rib.

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This is your rib the training edge of the rib getting attach to the rears par this is the rears par you can see and this is another rib.

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So now you can see the internal structure of the wing this is the fronts par you can see the fronts par from inside. Then this is a rib attach to the leading edge attached to the fronts par this is the rib the trailing edge being attached to the rears par this is your rears

par. So, we had seen the tools pars from outside also you can see them from inside this is the rears par this is another rib.

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So, this is another wing configuration this is a high wing on a sinus sin 12 motor blade you can see the wing attach on the higher side. So, this is another high wing example. Now we will see how this wing is attached to the fuselage. So, you can see the wing attachment for the high wing sinus sin 12.

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These are the tools spars you can see the spars moving through and through this is one attachment on the right side another wing attachment on the left side you can see the two attachments.

This is another attachment on the left side in addition to these two attachments there is one more attachment and this center. So, basically three bolts which are holding the wing the two wings of a high wings sinus sin 12 motor glider.

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So, you can see this is Hansa 3 aircraft a low wing aircraft you can see the wing attachment here it is on the lower position you are watching the wing attachment of Hansa 3.

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This is this bolt which you are seeing is the forward wing attachment of the right wing.

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There is another attachment on the rear side you can see this, this bolt there is a creep mark also this is the rear wing attachment of the right wing similarly on the left wing we have the similar attachments one on the front side and one on the rear side. You were seen the left wing now this is the wing attachment for the left wing this is the rear wing attachment you can see the bolt the rear ring attachment bolt whether big washer and similar attachment is there on the front side for the left wing also you can see the forward

attachment of the left wing this is the bolt. So, you have seen the wing attachment bolts two for the left wing and two for the right wing two on the right side. So, you have seen the wing attachment bolts there are 4 in number - two for left wing two on the right on the for the right wing, two front bolts and two rear bolts.

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So we are on Hansa 3 aircraft you can see this has a Rotax 914 f 3 engine this is the engine mount attached to the firewall this is the firewall these are the engine mount attachment bolts two on the right side this is the top attachment bolt the bottom attachment bolt similarly two bolts on the left side. So, these 4 bolts they attach the engine to the firewall. You can see this is the engine mount.

The engine is further attached to engine frame on 4 points with which has the rubber bolts for absorbing vibrations you can see the 4 mounts, this is the bottom one on the left side, the top one on the left side, the top one on the left side, similarly the two on the right side one at the top and one at the bottom.

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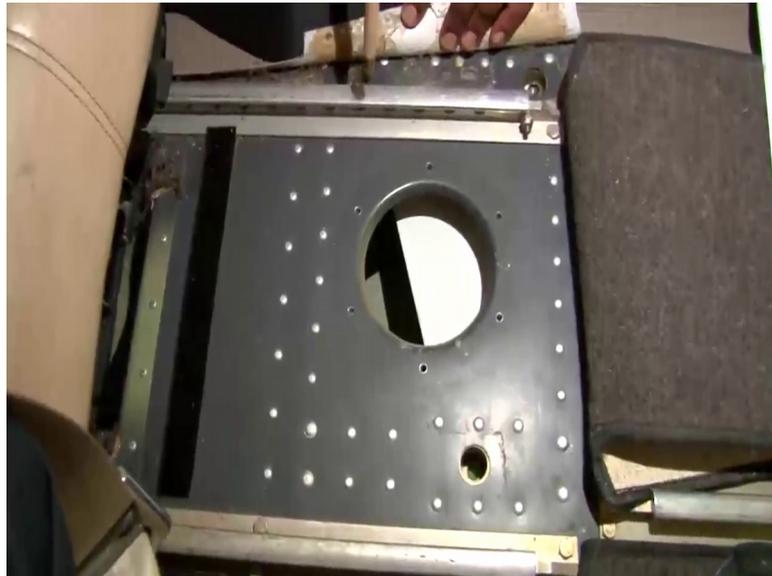
So, we are now watching the fix landing gear of Hansa 3 aircraft you can see this is the fixed landing gear which is attached by 8 bolts and all to the fuselage 4 bolts are on the right side you can see this is the landing gear attachment bracket two bolts two front bolts and then similarly two bolts are there on the rear side. So, total 4 bolts on the right side and similarly 4 bolts - two on the front and two on the rear on the left side. So, total 8 bolts attached the main landing gear to the fuselage.

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So now we are on Cessna 206 aircraft which has a main landing gear and a nose landing gear the landing gear configuration on this aircraft is a fixed one you can see this is the main landing gear of the left side. Similarly there is a on the right side you have a landing gear this is your nose landing gear which is again fixed.

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So, you can see the landing gear attachment this is the first attachment, second attachment and third attachment on the left side. So, you can see the three attachment bolts which attach the main landing gear to the fuselage, this is for the landing gear attachment on the left side similarly we have the attachment on the right side.

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So, you can see the those landing gear of Cessna 206 aircraft this is the first attachment point you can see and the second attachment point on this side the two attachment points on a fixed nose landing gear of Cessna 206 aircraft. This is your steering bell crank you can see the nose landing gear attachment of Cessna 206 aircraft. this is one attachment and then this is another attachment you can see, the two attachments for the fix nose landing gear of Cessna 206 aircraft. Then deep inside you can see these things these are the steering rods, this is the steering attachment you can see this is your steering arm or the steering bell crank with the with one attachment one rod attached here and the second one you can see deep inside here this is also attached.

So, the two steering rods these are your steering rods for the nose landing gear you can see the semi damper here, semi damper location and the oleo pneumatic strut and the nose gear focke you can see the nose gear focke here.

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So, we are now on piper saratoga aircraft which has a retractable landing gear.

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You can see the right main landing gear of piper saratoga aircraft these are the landing gear attachment points, you can see this is the landing gear attachment bracket the 4 bolts - 1 2 3 and 1 on the backside 4, these 4 bolts plus 1 attachment here. These attachments attach the main landing gear to the fuselage you can see the springs. So, is this is the retractable landing gear the spring you can see the hook the down lock hook this is the

down lock hook, the switches the electronic switches, the down lock switches plus you see the oleo pneumatic strut the tock links, the tier assembly and the break unit.

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So, this is piper saratoga aircraft you can see the landing gear of piper saratoga aircraft which is the retractable landing gear. Now you will see the retraction check, the retraction and extension check of piper saratoga aircraft layer clear.

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Yeah

Up, you have seen that the landing gear all three landing gears both main landing gears and on the nose landing gear have retracted they are now up we will. Now see how the landing gears are coming down – down. You can to see the gradual movement of the landing gears they are come down, now they completely down in locked you can see the three gears completely down and locked. There is an emergency check also on this air landing gear you will do an emergency check the retraction is normal the landing gears are normally retracted and with an emergency selection they are made to free fall you can see the landing gears again going – up. We have seen that the landing gears have now fully retracted the gears will now make an emergency free fall emergency down.

Emergency down (Refer Time: 18:18).

You can see now the emergency selection has been take put on and the gears are making of free fall. You have seen now the landing gears are now down and locked they have made of free fall after emergency selection was done.

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The tail plane of Cessna 206 aircraft comprises of the vertical stabilizer, the rudder horizontal stabilizer, elevator and an elevator trim tab.

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You can see the vertical stabilizer has got two spars the first spar, the second spar and the ribs. The skin is riveted to the spar and the ribs. Similarly the rudder, rudder has got a spar you can see spar and a rib. The skin is again riveted to the spars and the ribs.

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The rudder is attached to the vertical stabilizer by means of three mounting bolts. You can see the three mounting bolts here: one at the bottom, the middle mounting bolt, and the top mounting bolt. You can see the top mounting bolt, the rudder, this is the top mounting bolt, this is the middle mounting bolt, and

the bottom mounting bolt. Again coming to the horizontal stabilizer you can see the horizontal stabilizer also has a forward spar and the rear spar it is got a ribs and the skin panel is riveted to the spars and the ribs.

Similarly the elevator is also construct comprising of a spar and ribs skin panel is again riveted to the spars and the ribs. There is a balance weight at the elevator you just forward of the hinge line, you can see these are the balance weights one on the right side one on the left side. The elevator trim tab you can see the elevator trim tab is again comprising of it has got a rib and the skin panel is riveted to the ribs. You can see the elevator mounting the elevator is mounted to the horizontal stabilizer you can see the mounting of the elevator. Similarly similar mounting is there on the left side also. So, this is the right side you can see the elevator mounting bolt here. This you can see that is the rod attachment this attachment is for the elevator trim tab this is the elevator trim tab this is the elevator trim tab you have seen the control attachment of the trim tab here, this is the elevator trim tab attachment the elevator trim tab is hinge mounted you can see the hinge here hinge line it is hinge mounted.

Tail plane of a Cessna 206 aircraft is a full cantilever all metal construction with the vertical stabilizer the rudder horizontal stabilizer and an elevator with an elevator trim tab.