

MANUAL

English Electric Lightning T.5



All commercial law belongs solely to „The Anglo American Lightning Organisation (AALO)”

<https://lightning422.com>

The model is designed by „Peter Aircraft Factory”

Search for further informations with type this name on youtube .

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While attempts have been made to verify the correctness and reliability of the information provided in this document, the author does not assume any responsibility for errors, omissions, or contradictory information contained in this publication.

Never launch the model directly to other persons direction. Be carefull with the tools during building, and avoid any kind of injury.

This is a flyable realistic paper model. The develop of the model is based on 3 main aspects. The first aspect is to looks like similar to the real airplane. The second aspect is to be a flyable model. The third aspect is to be enough simple to build. To take this three aspect in one desing, I had to find compromise between this aspects. This means, for example, some places, I made the plane not as realistic lookslike as a static model, for easier build, or better flight performance.

Some thoughts about the used materials.

I mad the wings from hard paper, for the reasons of strength. Several other designer use two piece of copy paper sticked together for this purpose. I tried out this method, but I found better solution the duplex printing on hard paper, fewer work, and no chance for bad sticking, and no need liquid glue.

I cover the model with scotch tape, this is another unusual method. Scotch tape gives more strenght for the material, protect the paper from mechanical damages, worn, and gives limited waterproof. (wich does not means, that the model is waterproof, only means, if the model lands in a puddle, and you dried it, you have got good chance to save it, while uncovered paper surfaces become wrinkled.) Scotch tape makes the lifespan of the model much more longer depending on usage.

Some thoughts about building and flying.

If you are new in paper modelling, and flying paper airplanes, you have to be persistent. Your first plane will not be perfect probably, but dont give up. Watch the whole document attentively first, and keep close to you durring the construction. I teached for some of my friends personaly how to fly my paper models, and usually they failed for first, but after a few hour practice, they learned the method, mastered it, and enjoyed the outdoor flying.

At every outdoor flight occasion, there will be several launch, when the plane become unstable, and crashes. But after you find the reason of this, and you corrigate the flight path with the right setup of control surfaces, the model will recompense you with several beautifull flight.

REQUIRED MATERIALS, TOOLS:

80 gramm/ m2 copy papers.

160-180 g/m2 hardpapers

scissors

little scissors with pointed end

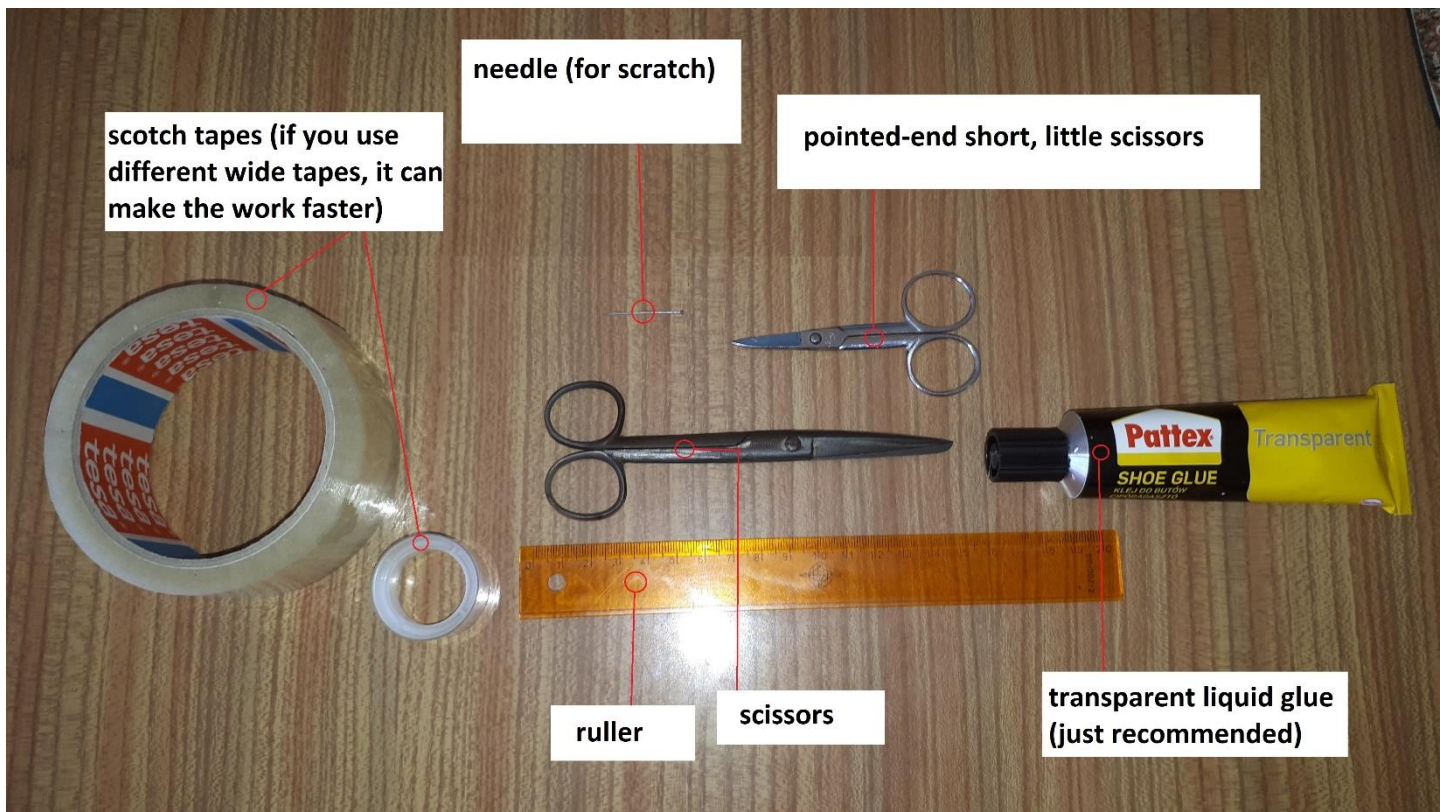
needle (for scratch)

ruller

scotch tape

only recommended, but not obligatory material: transparent liquid glue. You can skip the usage of this, but I recommend it at several place. Make a test with the glue on two piece of unnecessary copy paper.

Don't use glue, which deform or wrinkle the paper.



PRINTING

Print PAGE 1 and PAGE 1 BACK on the same paper, with „duplex setup” with the configuration „turn near longer side”

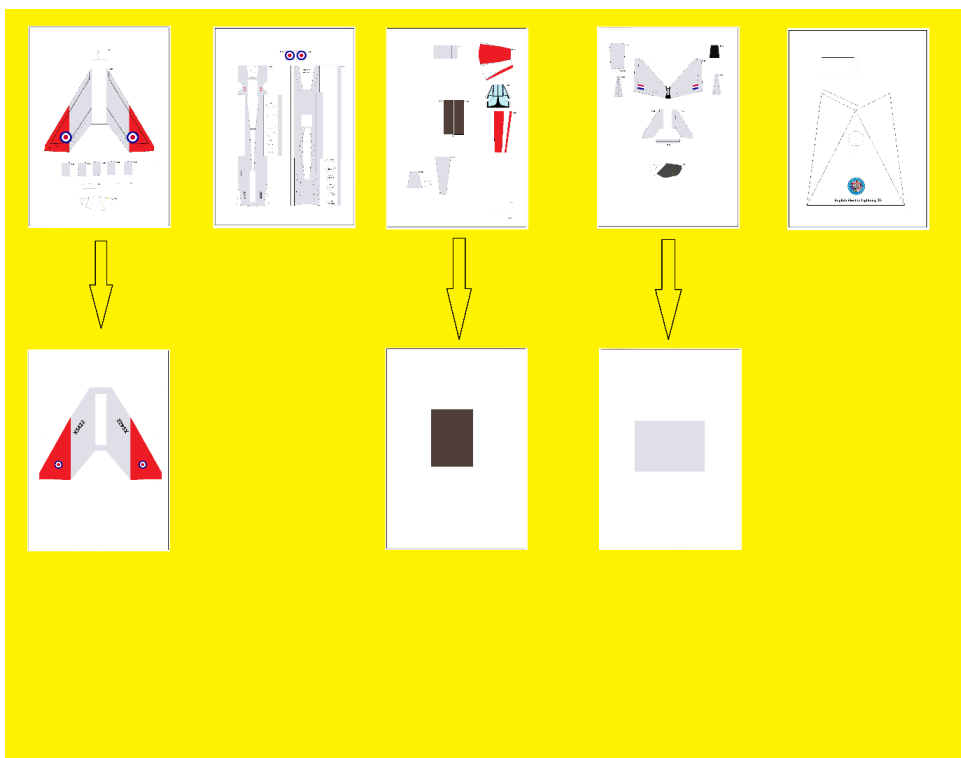
Print this page on hard paper.

Print the stand on hard paper too.

Print other pages on copy paper, with the same configurations.

Wings span have to be about 15 cm long, fuselage main parts (P.5 and P.10) have to be about 20 cm long.

Small differences in printed size (max 1-2 cm) are not problem, if the parts keeps their exact size relative to eachother. If there are bigger differences in size, the behavior of the plane in the air can change drastically.



Advices for the build

-Before you start the work, read this manual attentively, and keep it near you during the build.

-Work always with clean hands.

-Keep clean the scotch tape and the surfaces before you fix anything

-For first build, print out everything twice. If you make mistake, you dont have to stop with the work.

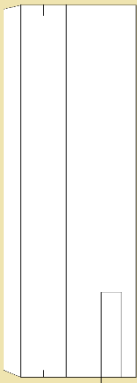
-scratch gently the paper with a needle near a ruller before the folds, where instructions show this.

The meaning of the markings

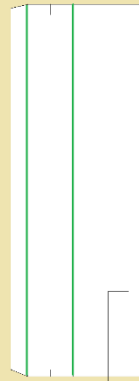


STEP 1.

CUT OUT P.1.

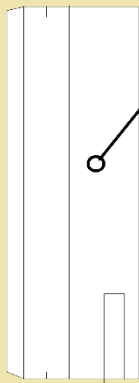


SCRATCH IT NEAR THE FOLLOWING LINES

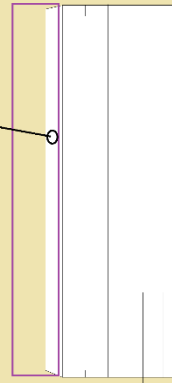


BEND IT NEAR THE SCRATCHED LINES

CURVE THIS AREA



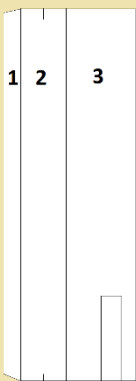
TAKE A
PIECE OF
SCOTCH
TAPE ON
THAT SIDE.
THIS AREA HAVE
TO BE OUTSIDE



AREA 1 WILL COVER PART 3 PARTIALLY.

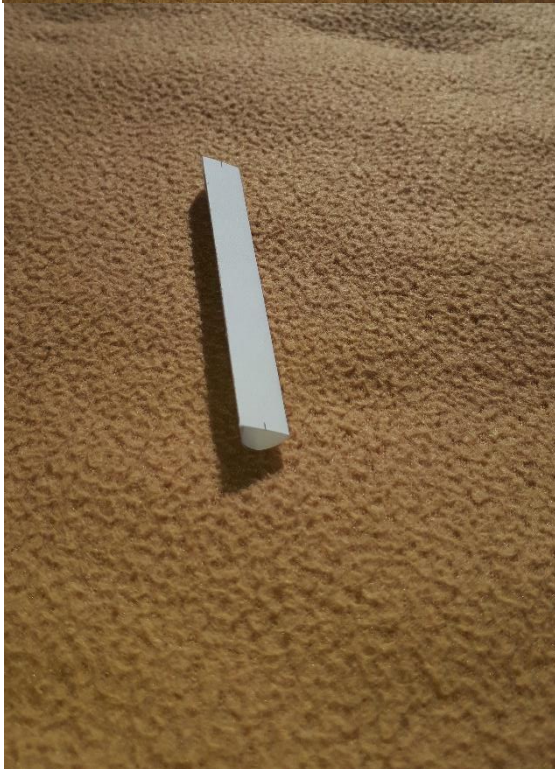
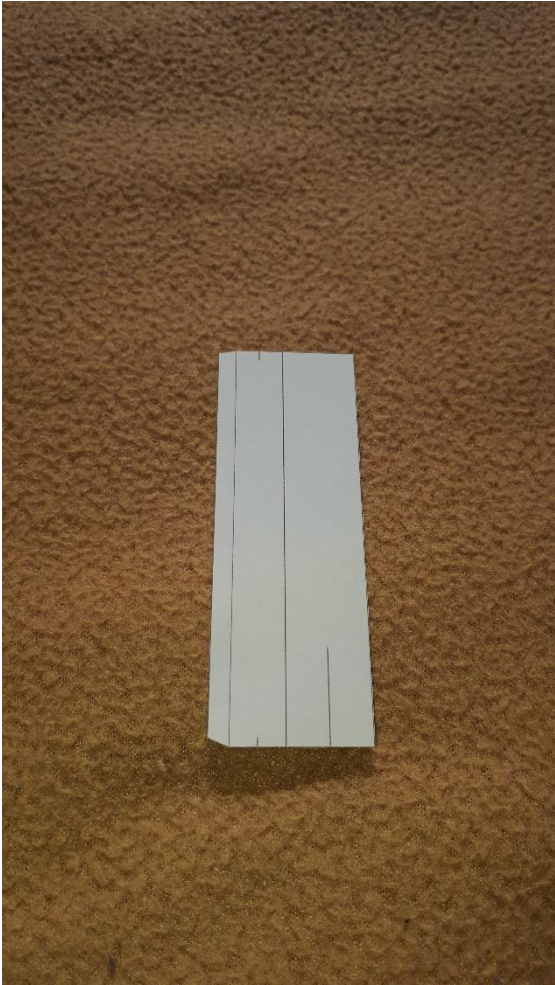
AREA 2 IS A FLAT AREA

AREA 3 IS A CURVED AREA.



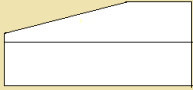
FIX AREA 1 ON
AREA 2 WITH SCOTCH
TAPE.

STEP 1.



STEP 2.

CUT OUT P.2.



SCRATCH NEAR THIS LINE



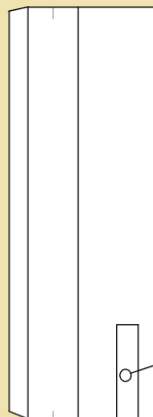
FOLD IN 90° NEAR SCRATCHED LINE



WITH A PIECE OF SCOTCH TAPE FIX IT TO P.1.



THIS EDE HAVE TO LOOK FORWARD



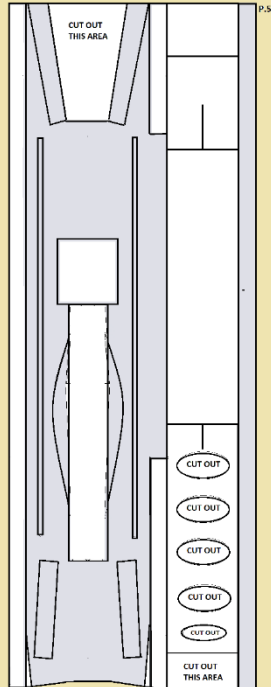
PLACE OF P.2.

STEP 2.

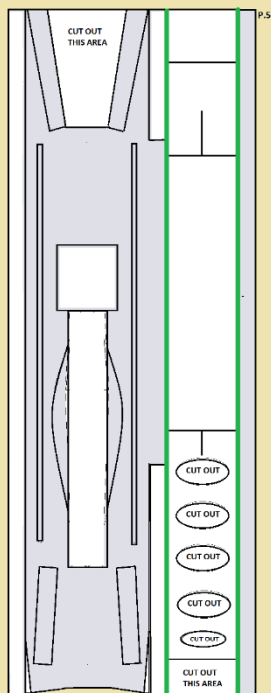


STEP 3.

CUT OUT P.5.

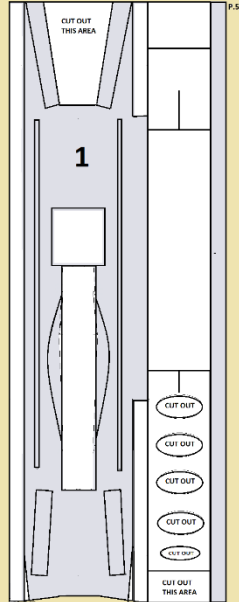


SCRATCH NEAR THE MARKED LINES

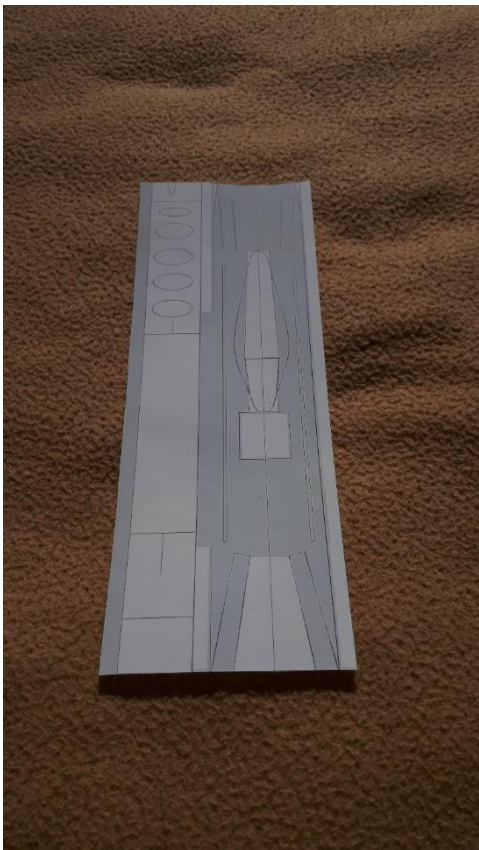


STEP 3.

FOLD THE PAPER NEAR THE SCRATCHED EDGES.

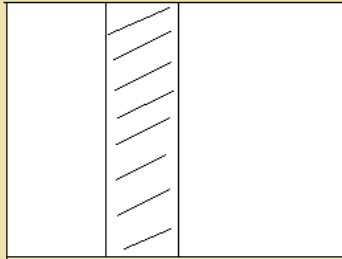


CURVE AREA 1.

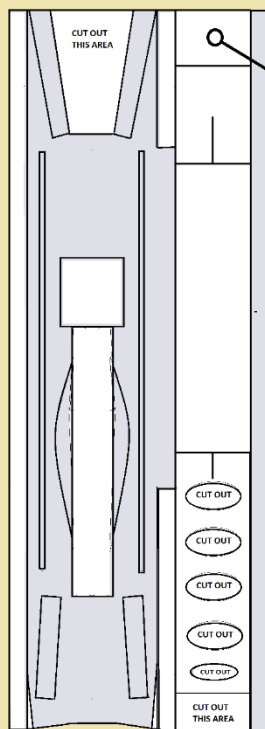
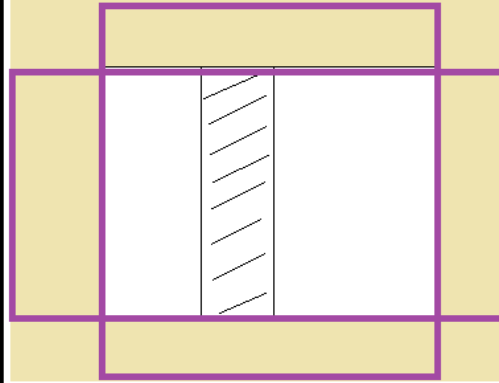


STEP 4.

CUT OUT P.3.

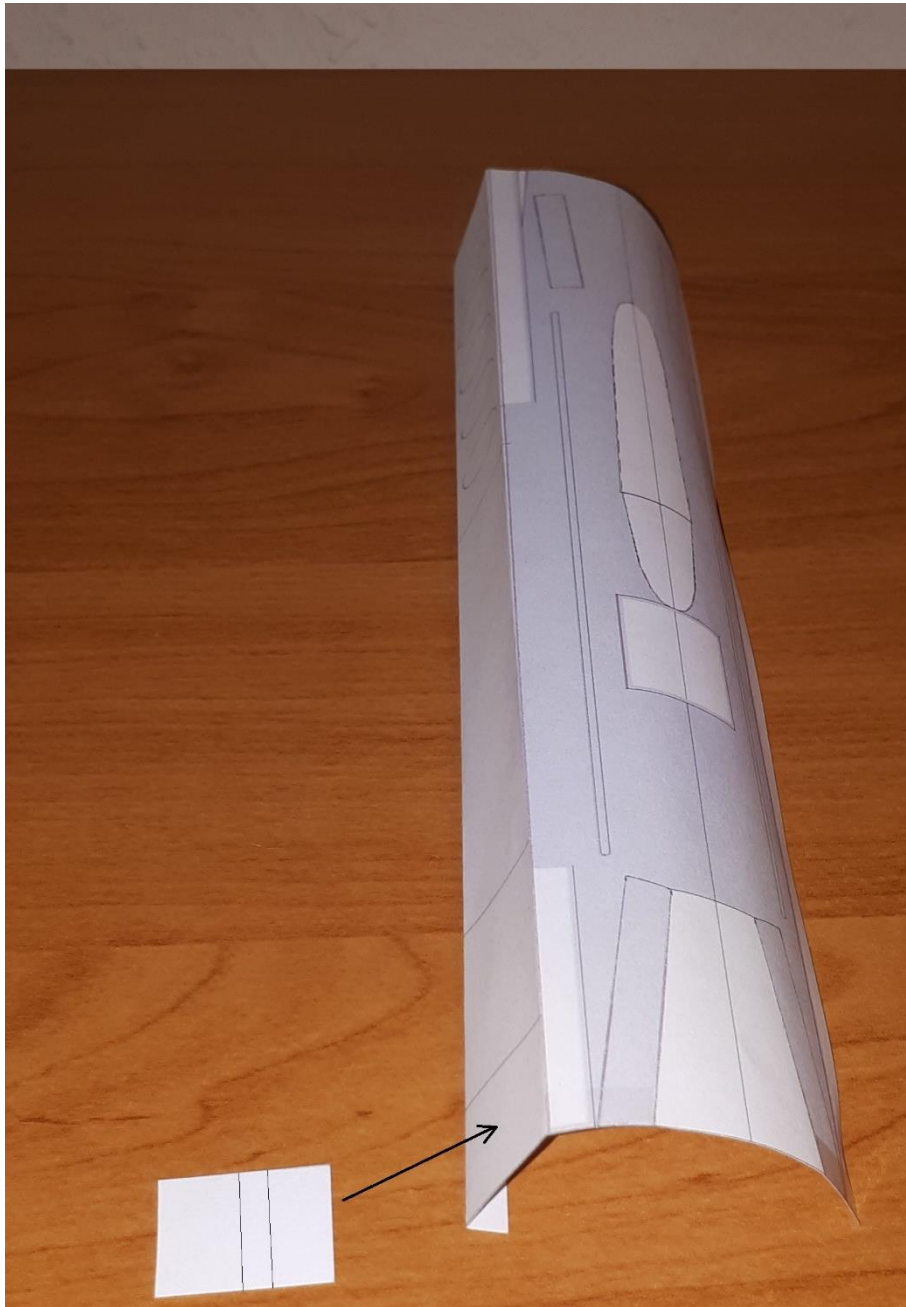


WITH TWO PIECE OF SCOTCH TAPE, FIX IT ON P.5.



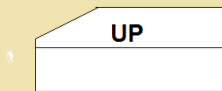
**PLACE OF
P.3.**

STEP 4.

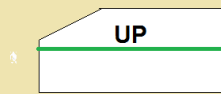


STEP 5.

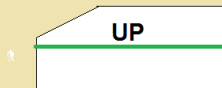
CUT OUT P.4.



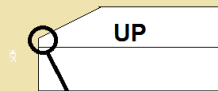
SCRATCH NEAR THIS LINE



FOLD IN 90° NEAR SCRATCHED LINE



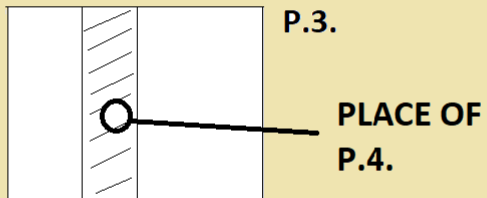
**WITH A PIECE OF SCOTCH TAPE
FIX IT TO P.3.
FIX IT AT THE MIDDLE OF
P.3.!**



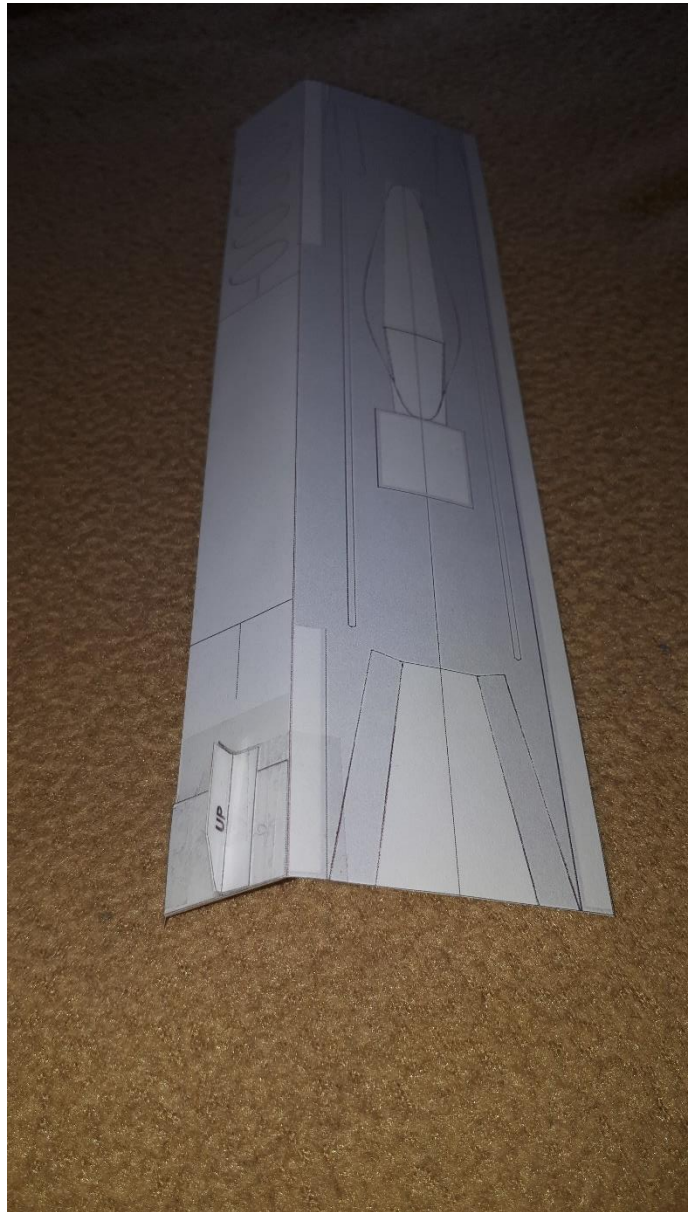
**THIS EDGE HAVE TO LOOK
FORWARD**

STEP 5.

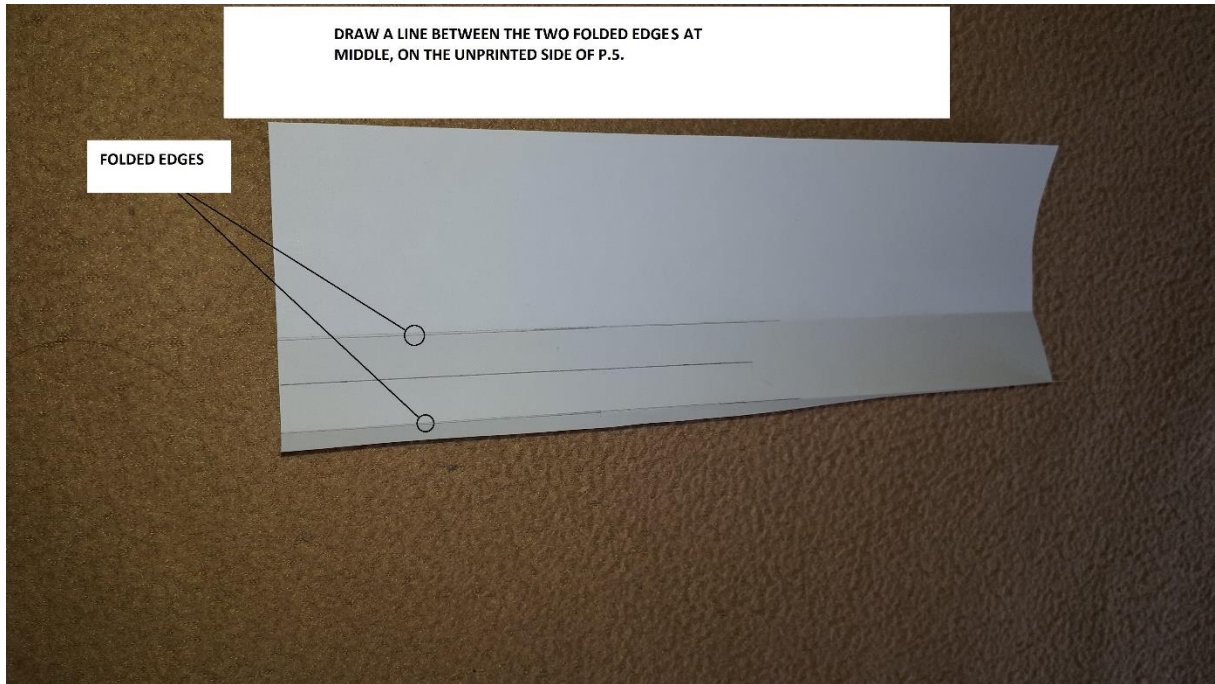
**FIX IT WITH SCOTCH TAPE ON P.3.
AND P.5. , AS YOU MADE THIS WITH
P.2.**



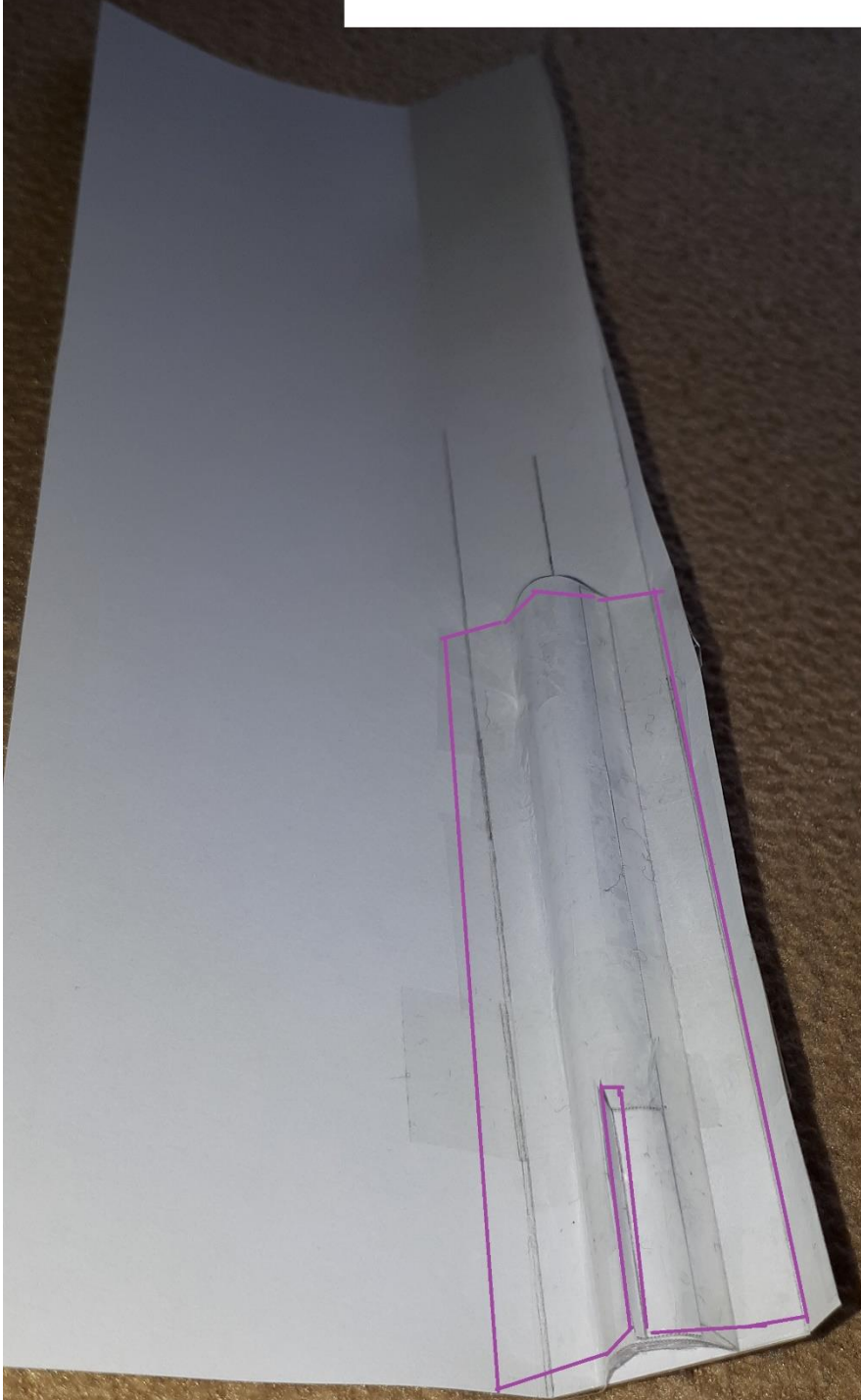
**P.4. IS LONGER THAN P.3., DONT
WORRY ABOUT THAT.**



STEP 6.



FIX P.1. IN THE UNPRINTED SIDE OF P.5. WITH SCOTCH TAPE. TAKE IT TO MIDDLE, WATCH THE DRAWED LINE FOR THIS. STICK DOWN ALONG THE TWO SIDE THIS PART DONT LET OUT ANY SURFACE.

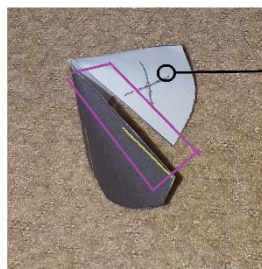
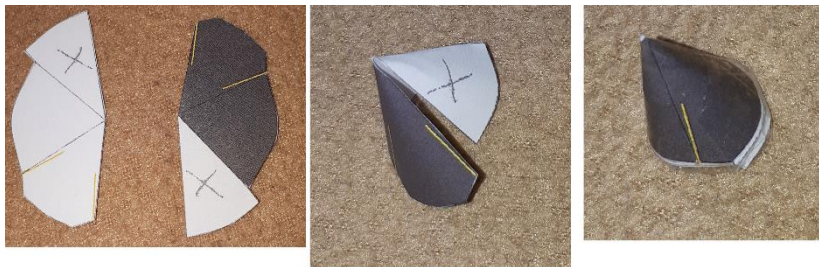


STEP 7.

CUT OUT P.6. AND P.7.

CURVE THEM AND FORM CONES FROM THEM.

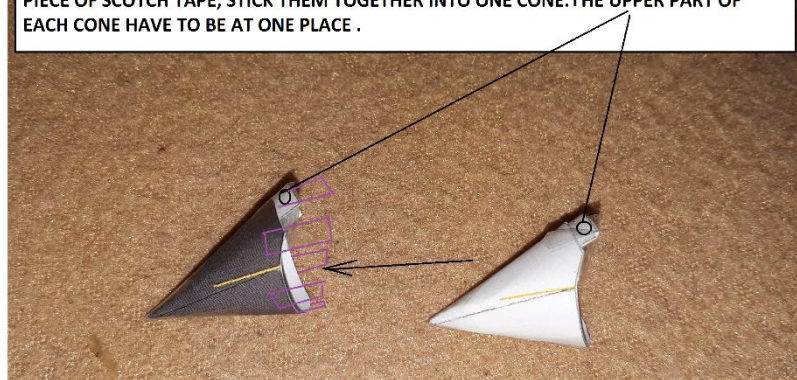
FIX THEM WITH SCOTCH TAPE, THEN COVER THEM.



COVERED
AREA



PUSH THE HARD PAPER CONE INTO THE COPY PAPER CONE, AND WITH SEVERAL LITTLE
PIECE OF SCOTCH TAPE, STICK THEM TOGETHER INTO ONE CONE. THE UPPER PART OF
EACH CONE HAVE TO BE AT ONE PLACE .



STEP 7.

CUT IN THE CONE WITH A LITTLE, POINTED END SCISSORS NEAR THE TWO YELLOW LINES. BE CAREFULL, TO NOT CUT IT LONGER OR SHORTER, THEN THE LINES.

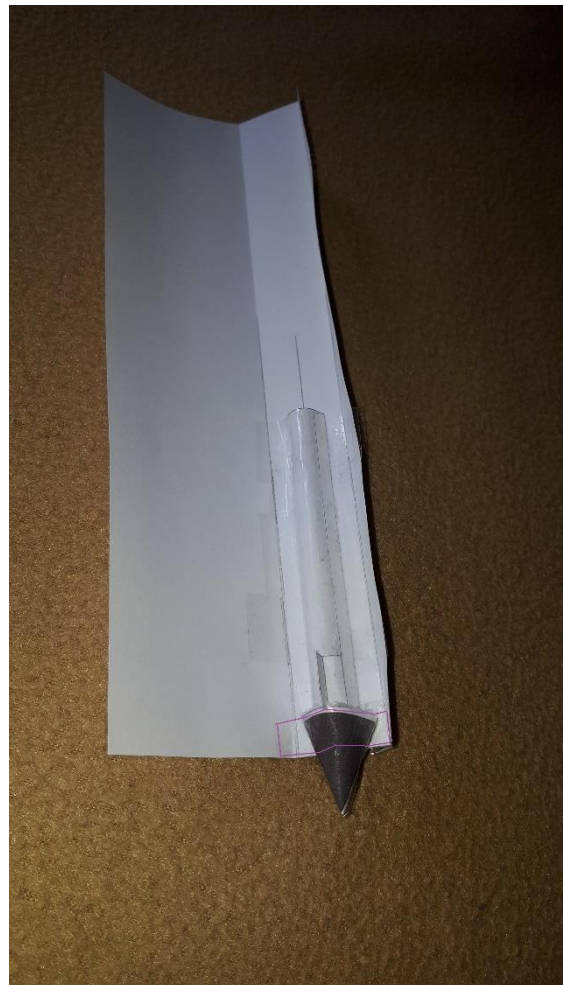


STEP 8.

PULL THE MACH CONE ON THE FUSELAGE.

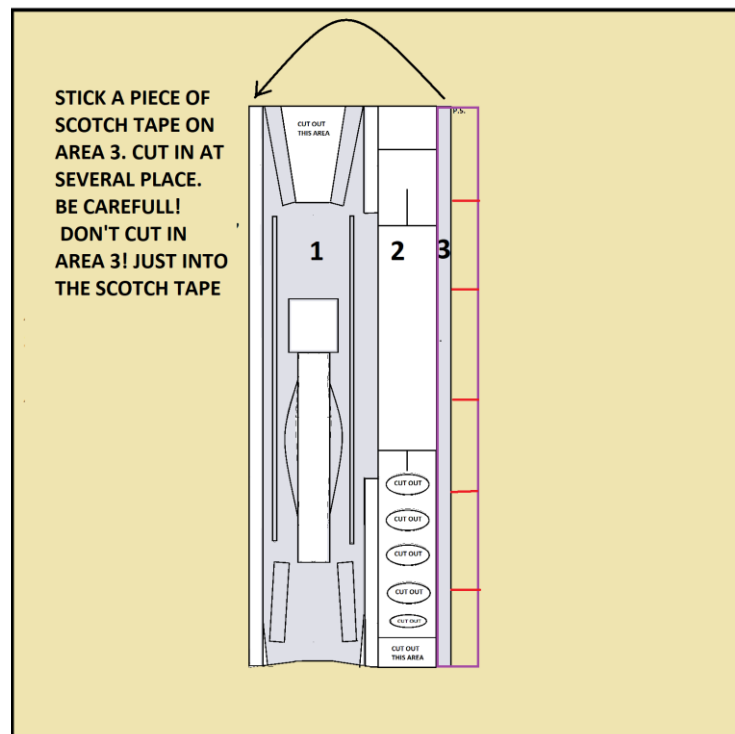
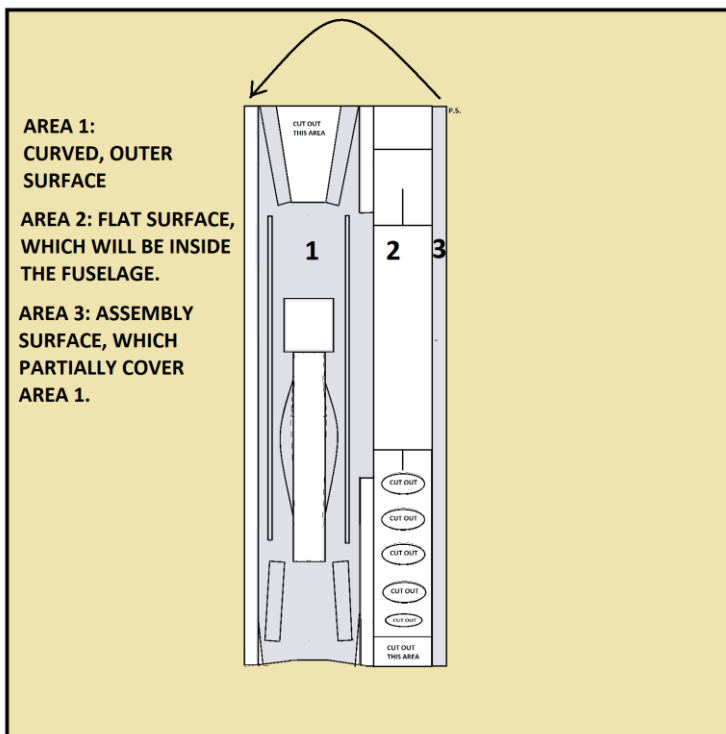
IMPORTANT!

THE WIDER AREA OF THE CONE HAVE TO LOOK DOWNWARD. FIX IT WITH SCOTCH TAPE FROM EACH SIDE. KEEP IT AT MIDDLE.

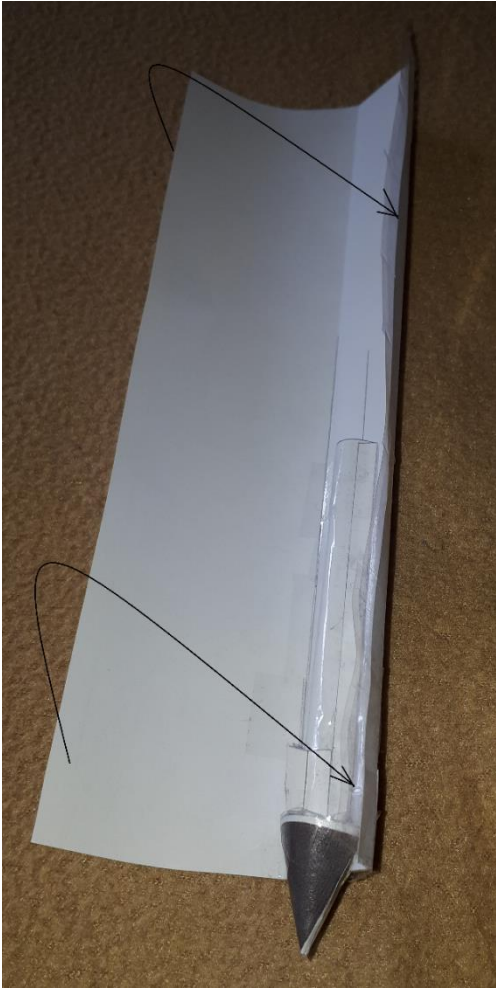


STEP 9.

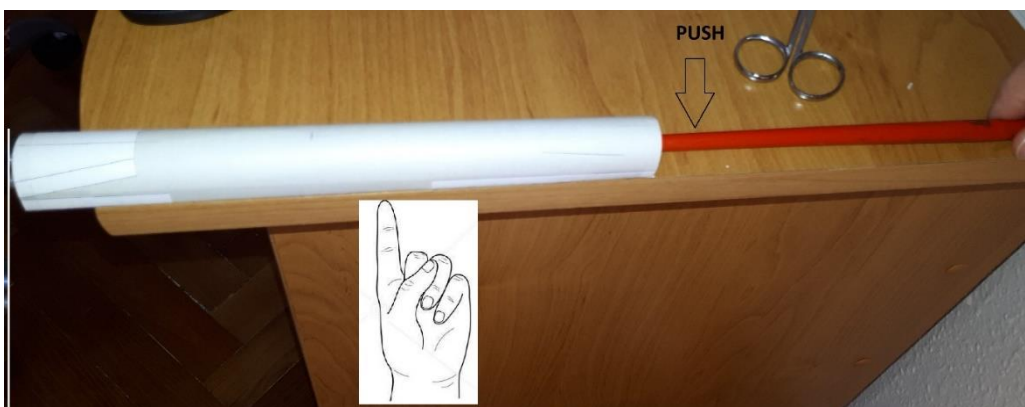
STICK TOGETHER WITH SCOTCH TAPE THE TWO SIDE OF THE FUSELAGE. LAY IT DOWN ON A FLAT SURFACE (FOR EXAMPLE, A TABLE) FOR THIS. YOU CAN ALSO STICK IT TO THAT SURFACE TEMPORARY WITH LITTLE PIECE OF SCOTCH TAPE. THIS HELP YOU TO AVOID TWIST.



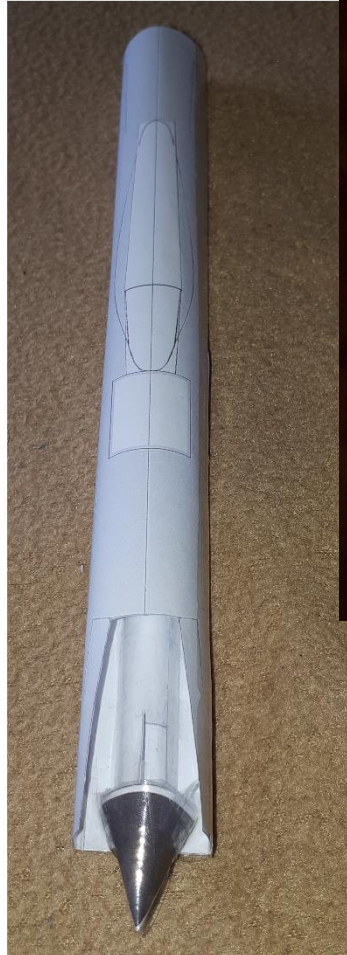
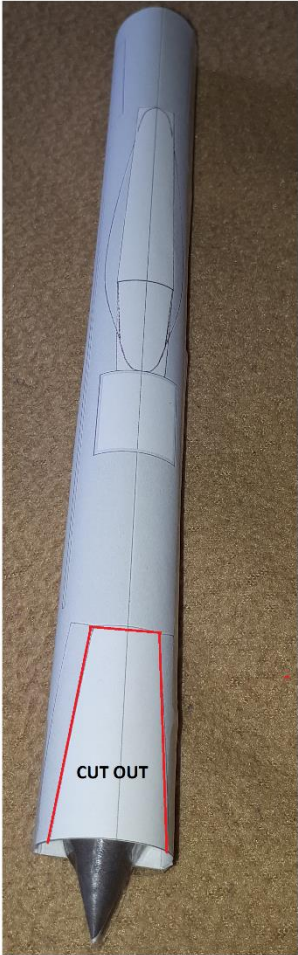
STEP 9.



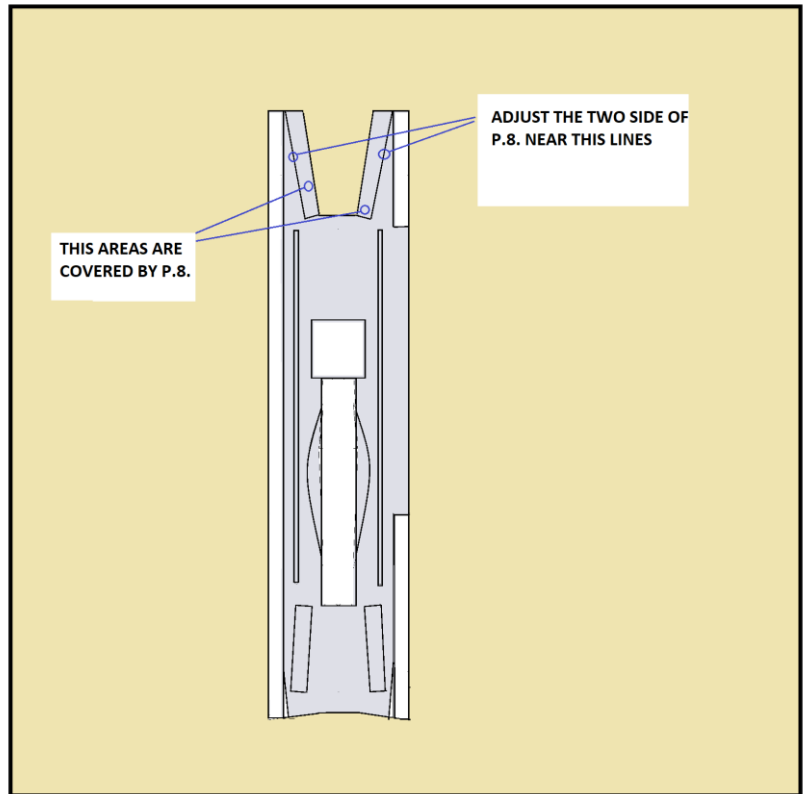
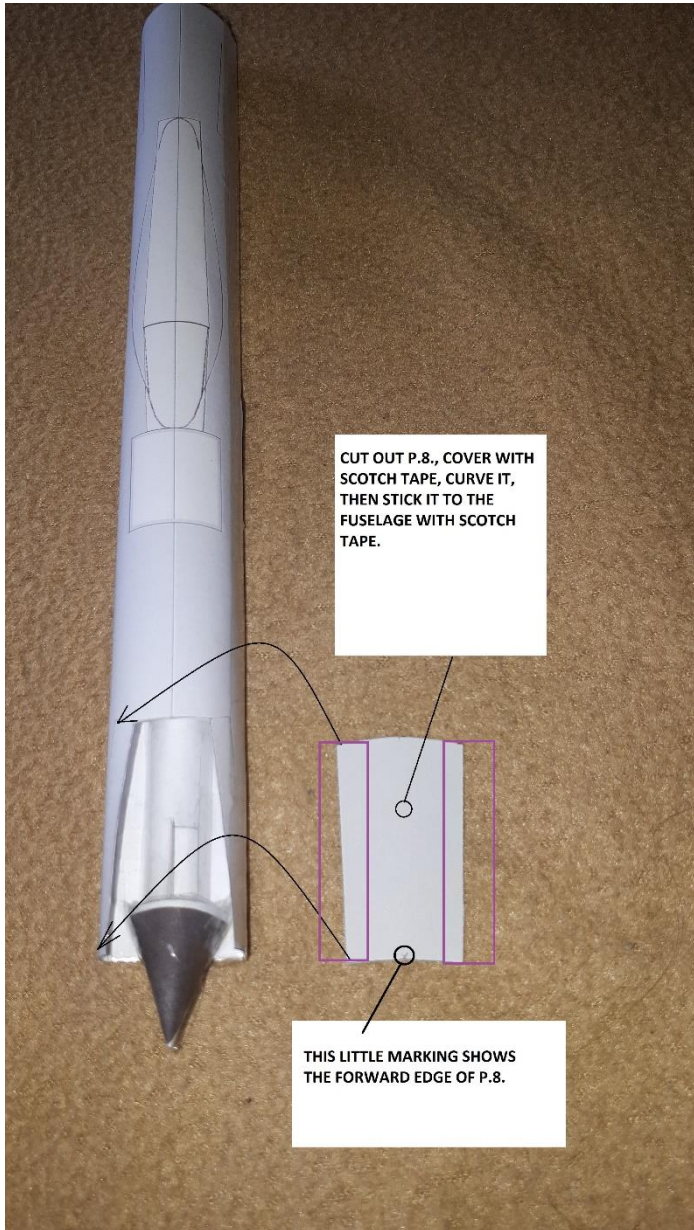
TAKE A PENCIL INTO THE FUSELAGE AT THE JUNCTION ,
AND PUSH TOGETHER FROM TWO SIDE THE MATERIAL
FOR GOOD STICKING.



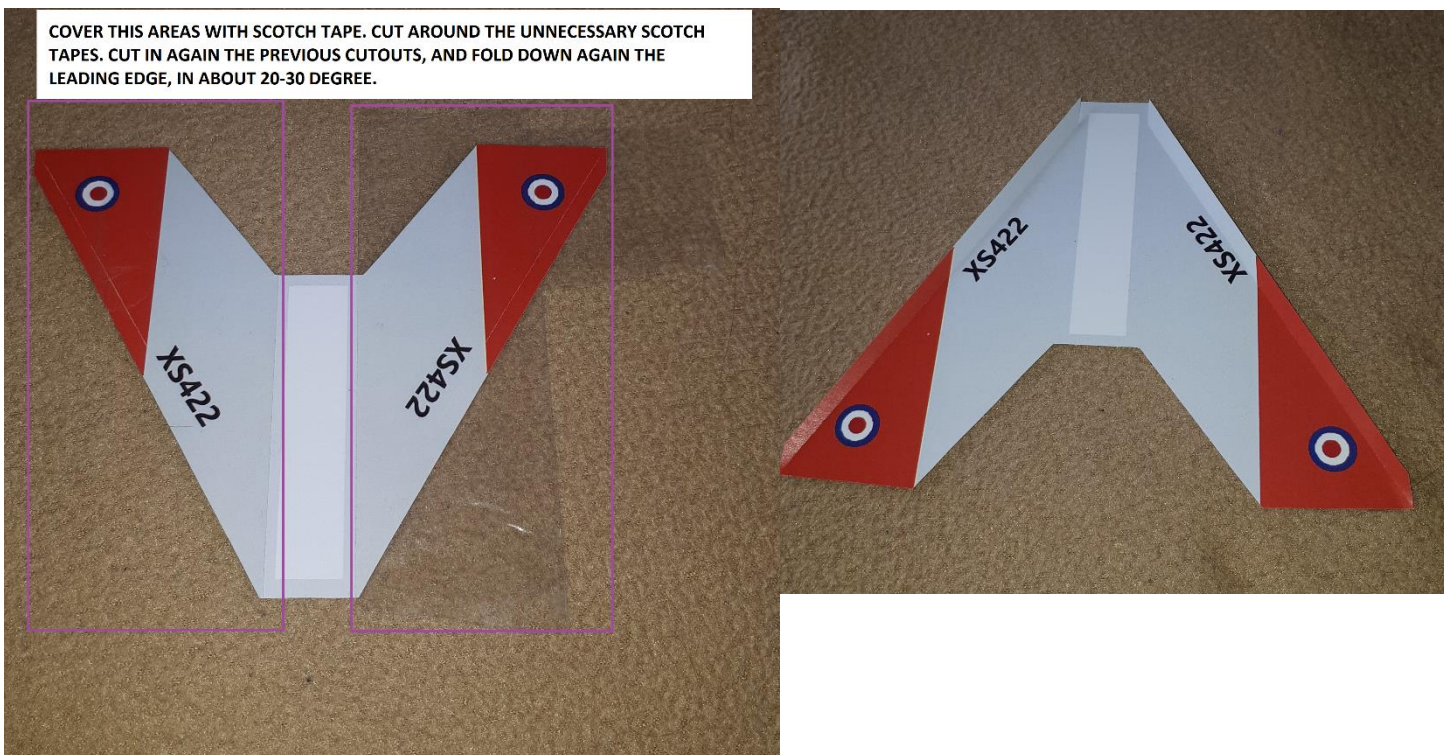
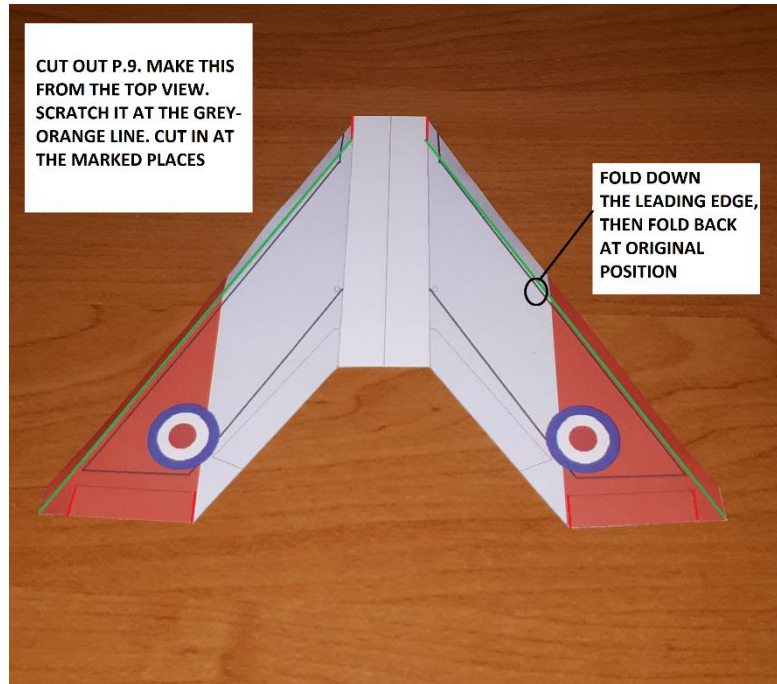
STEP 10.



STEP 11.

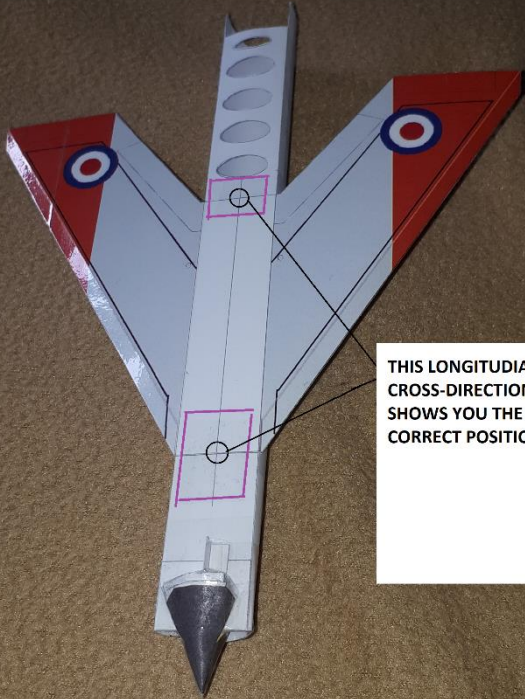


STEP 12.



STEP 13.

FIX THE WING ON THE FUSELAGE WITH SCOTCH TAPE. IF YOU HAVE GOT GLUE WHICH IS NOT WRINKLE OR DEFORM PAPER, YOU CAN USE THAT ALSO! IF YOU USE GLUE, TEST IT ON A SIMPLE PAPER, BEFORE YOU USE IT ON THE PLANE.



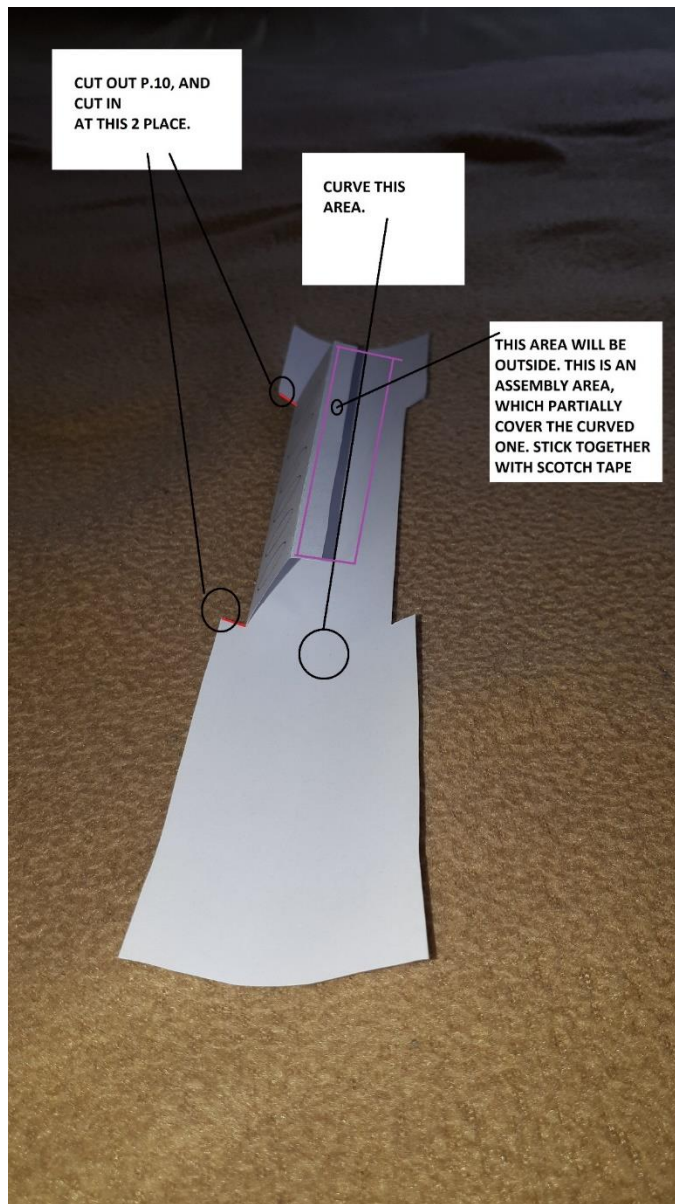
THIS LONGITUDIAL AND CROSS-DIRECTION LINES SHOWS YOU THE CORRECT POSITION

STICK THE WING TO THE FUSELAGE WITH SCOTCH TAPES FROM THIS DIRECTION TOO

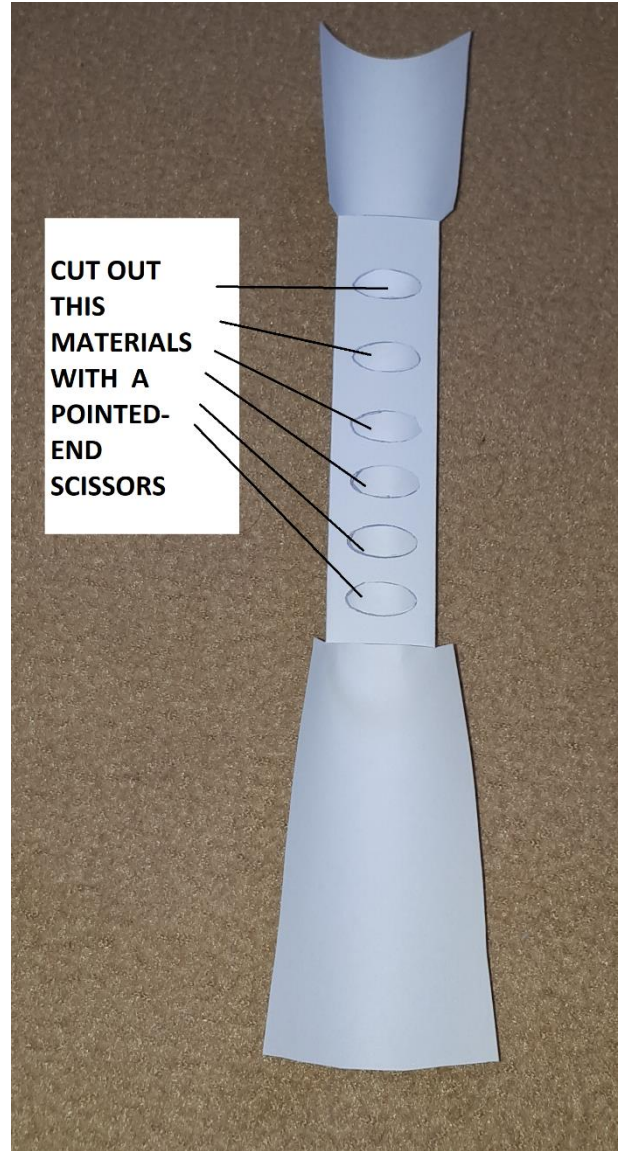


STEP 14.

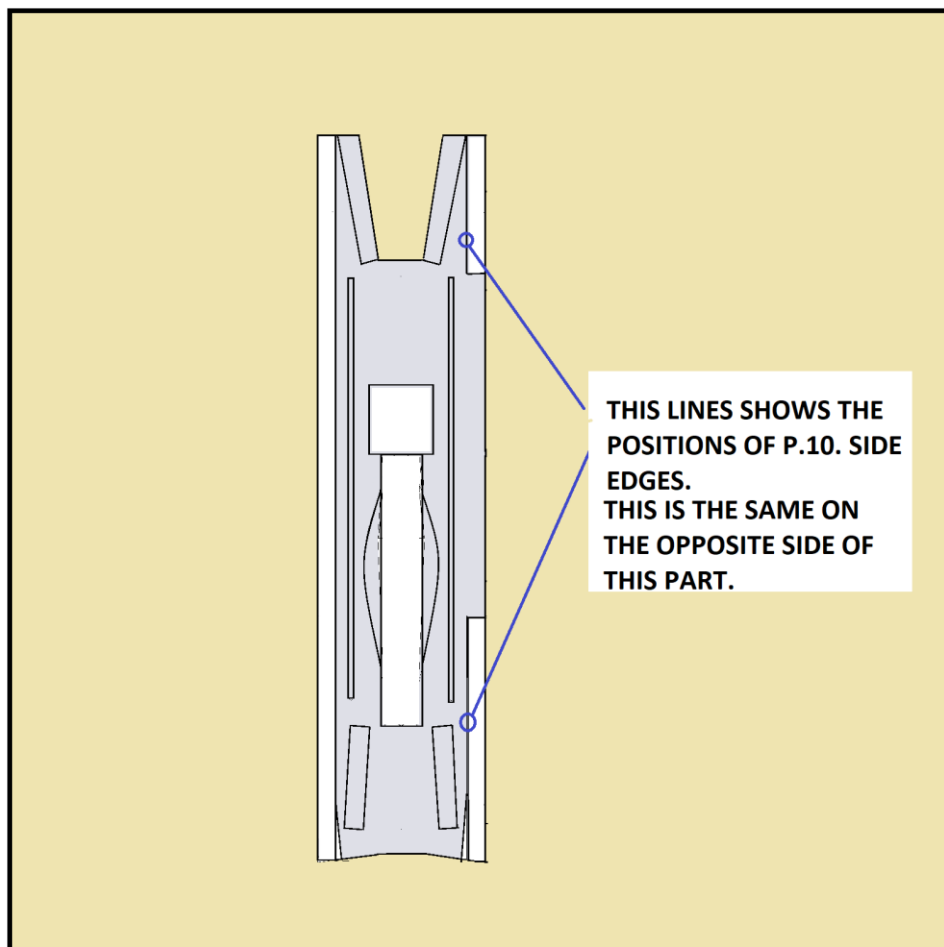
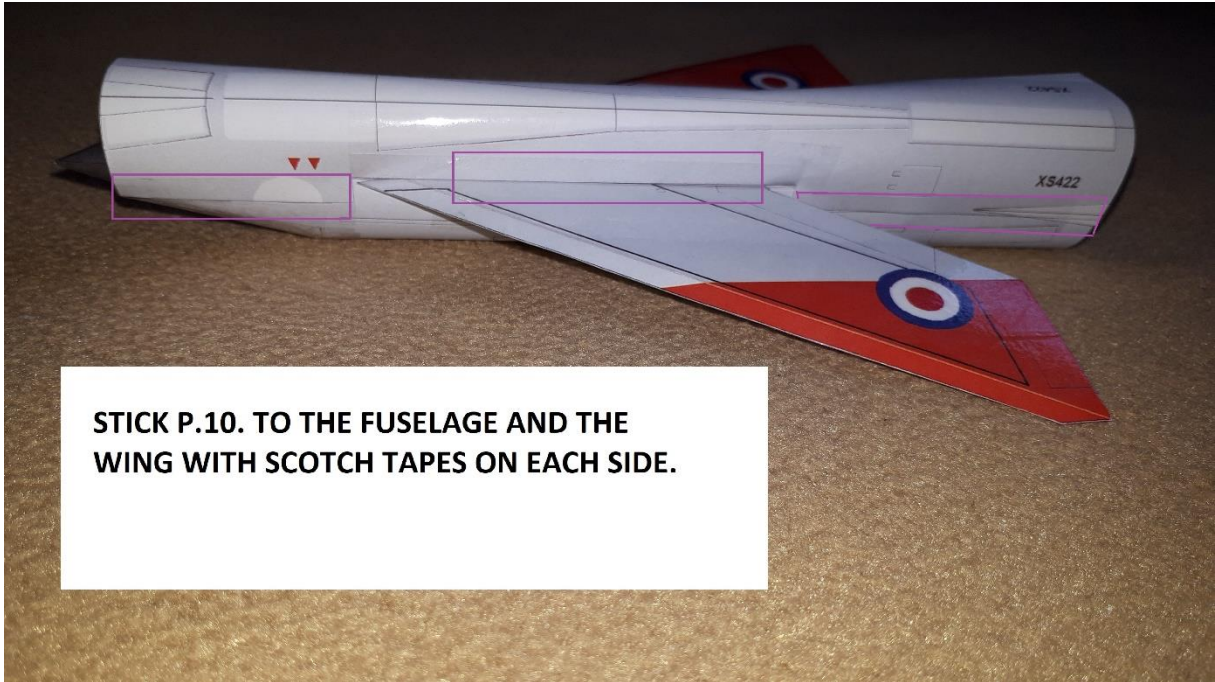
ATTENTION! I MODIFIED THE TEMPLATE OF P.10., AND I EXTEND THE FLAT AREA FOR THE REASON OF EASIER BUILD. SO DON'T WORRY, IF YOUR P.10. PART IS NOT LOOKS LIKE THE SAME, AS IT IS SHOWED ON THIS PHOTOS. JUST FOLLOW THE MANUAL, AND CUT OUT AREAS FROM P.10. WHERE YOU CAN READ „CUT OUT”



STEP 14.



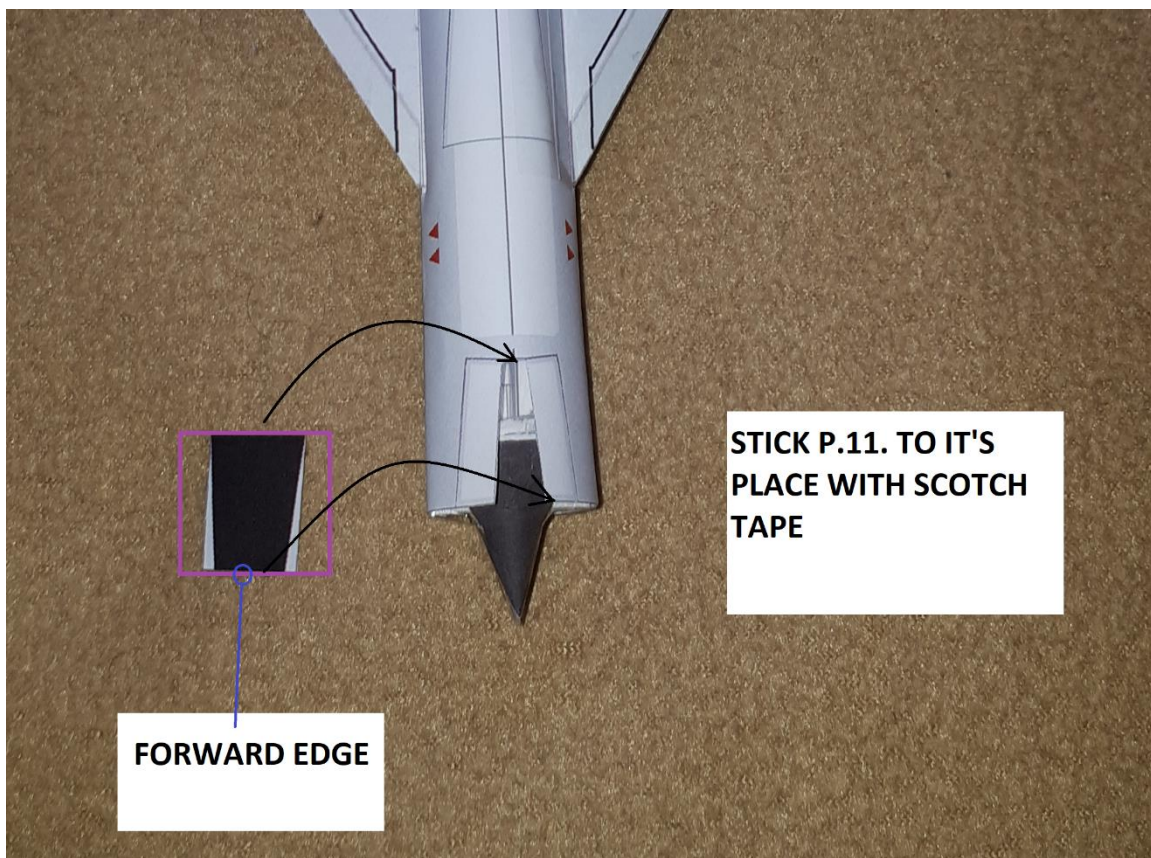
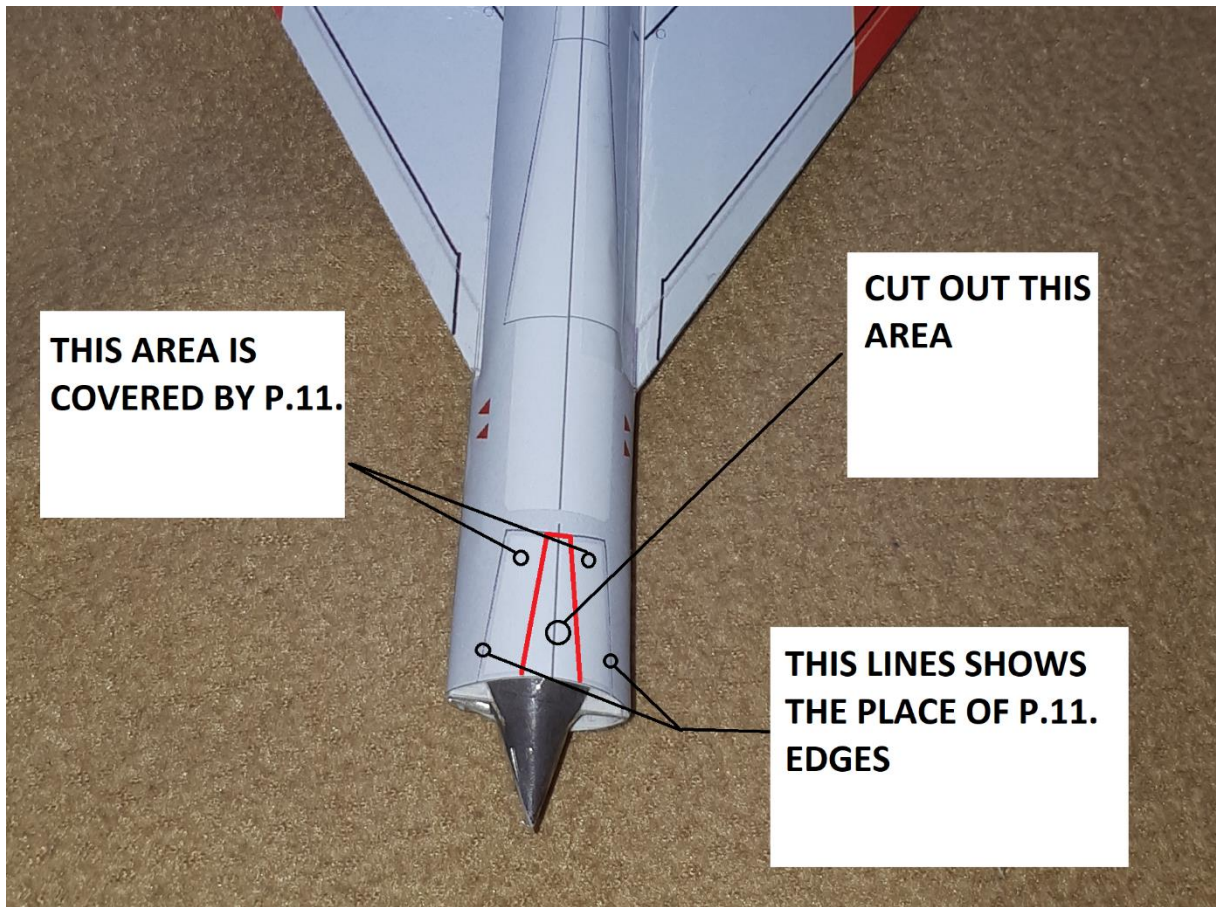
STEP 15.



STEP 15.

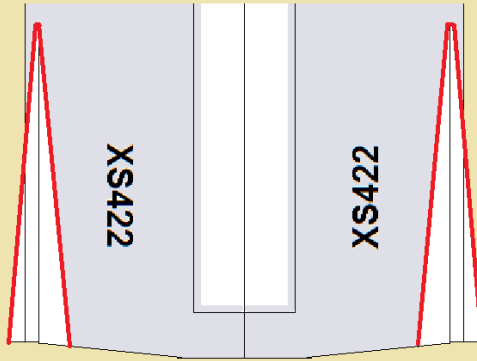


STEP 16.

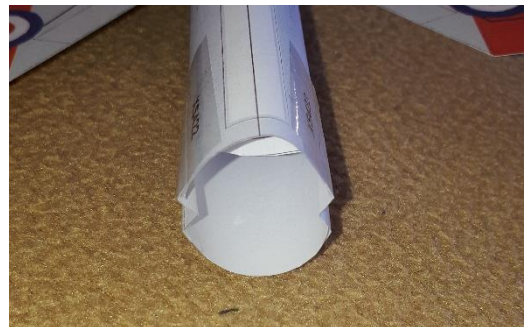
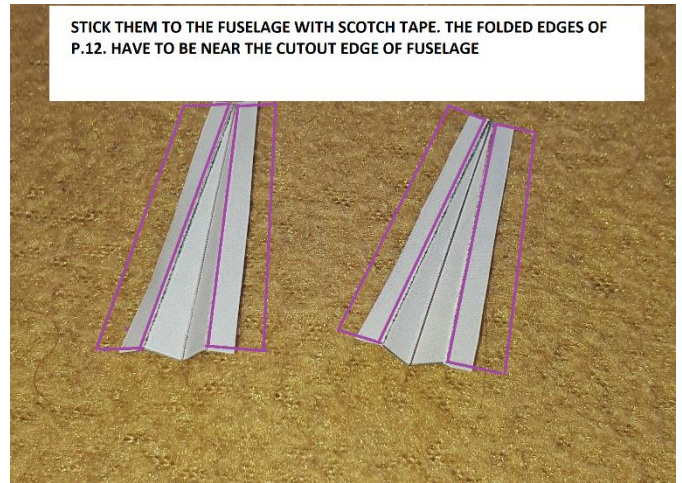
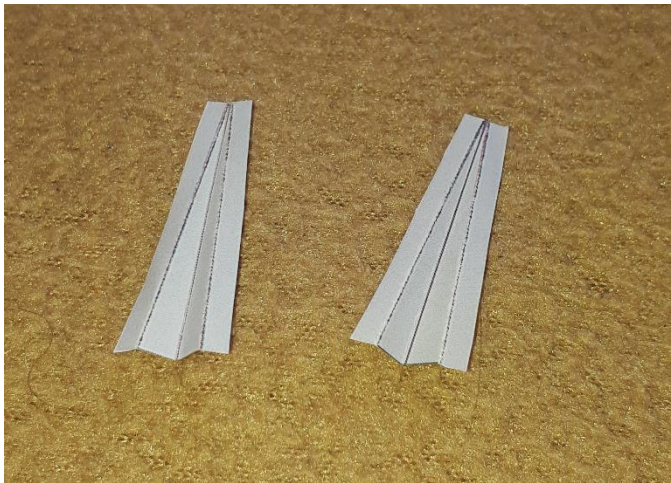
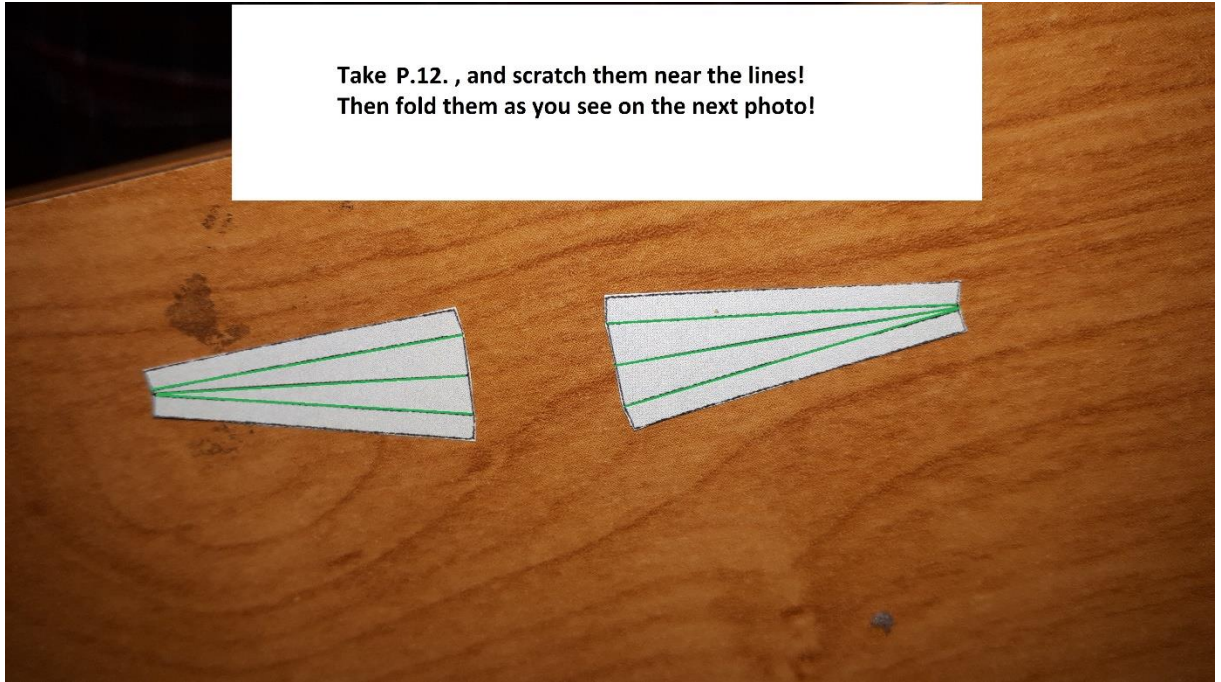


STEP 17.

**CUT OUT THIS AREAS
MARKED WITH RED**

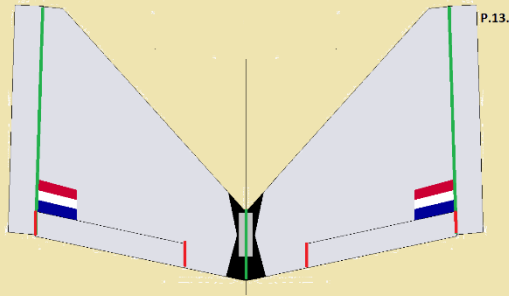


STEP 18.

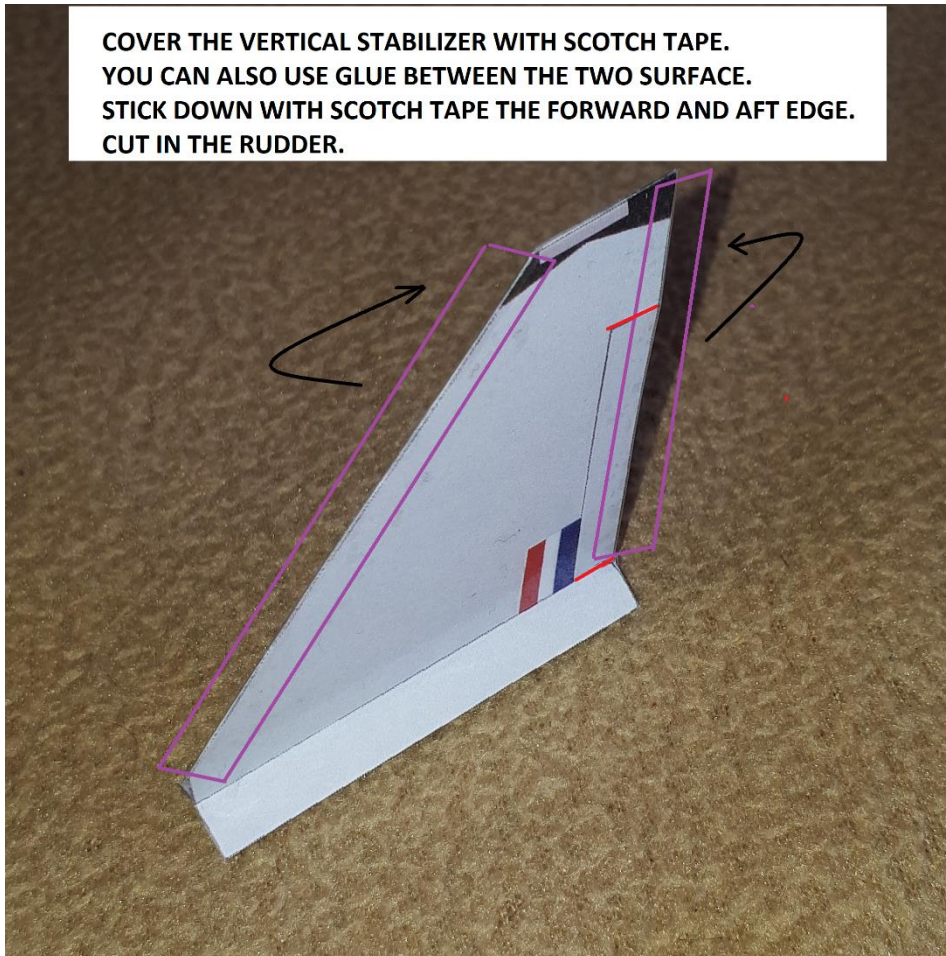


STEP 19.

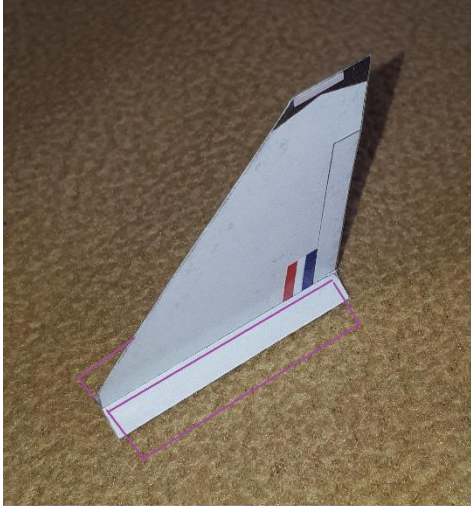
**CUT OUT P.13. SCRATCH IT NEAR THE MARKED LINES.
FOLD IT AS YOU CAN SEE AT THE NEXT PHOTO.
STICK TOGETHER WITH SCOTCH TAPE AT
FORWARD AND AFT EDGE.**



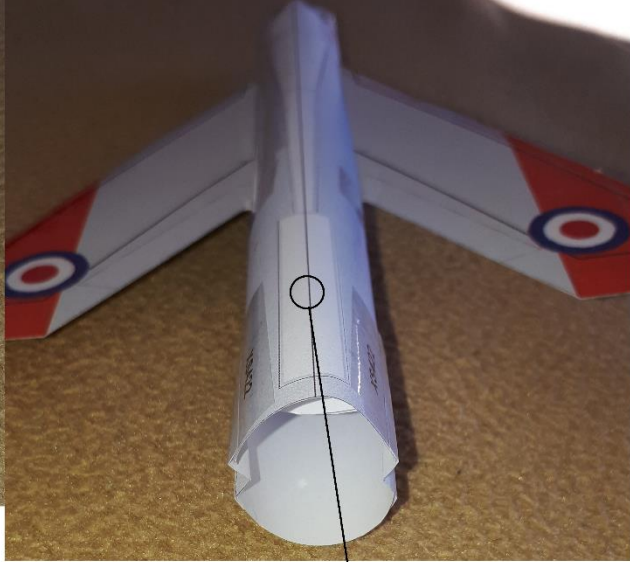
**COVER THE VERTICAL STABILIZER WITH SCOTCH TAPE.
YOU CAN ALSO USE GLUE BETWEEN THE TWO SURFACE.
STICK DOWN WITH SCOTCH TAPE THE FORWARD AND AFT EDGE.
CUT IN THE RUDDER.**



STEP 19.



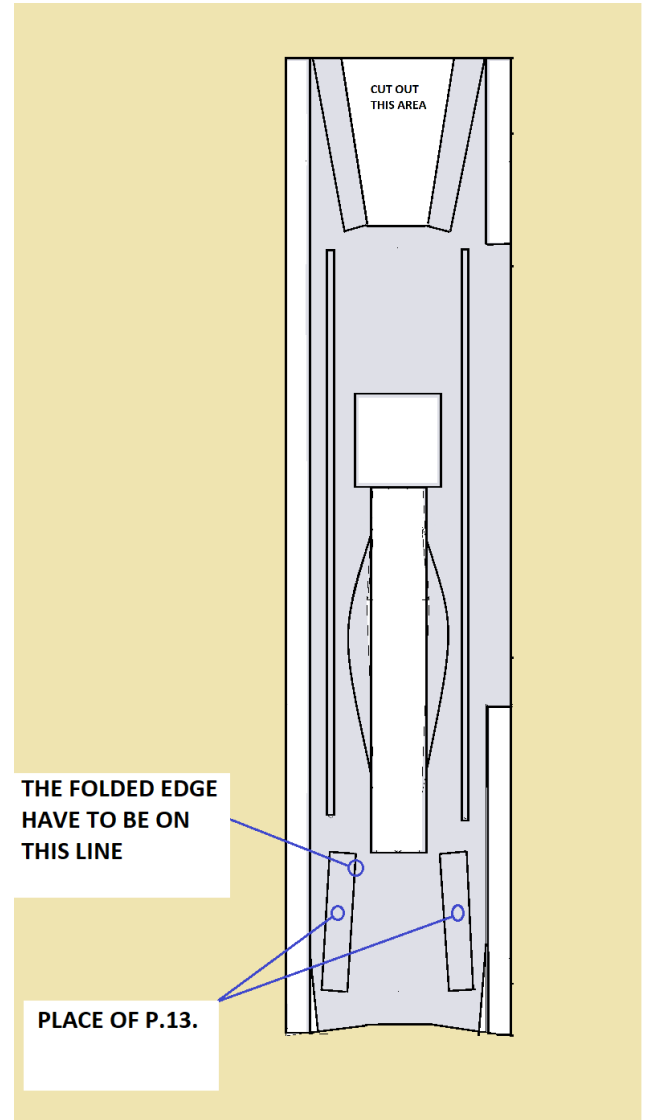
STICK P.13. TO ITS PLACE WITH SCOTCH TAPES



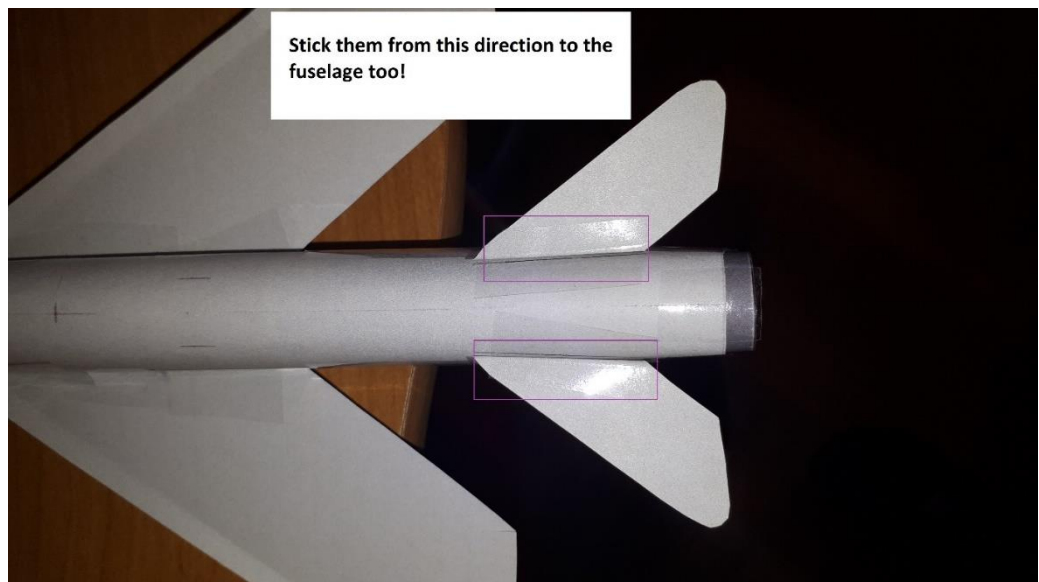
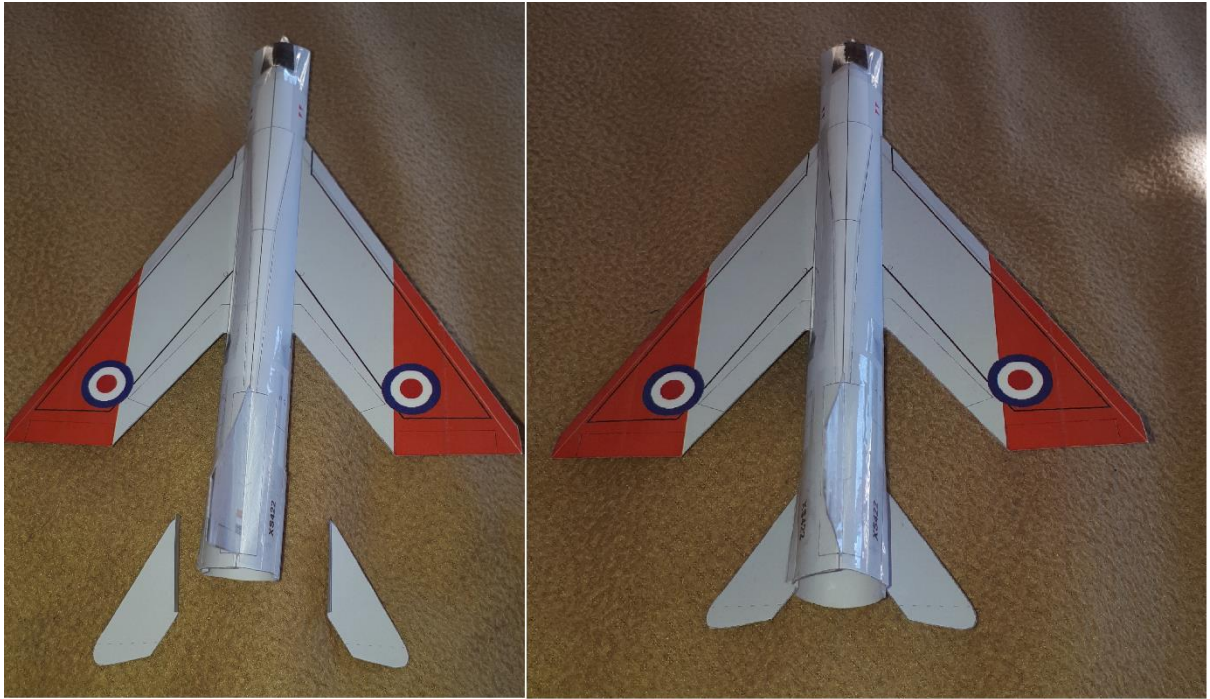
PLACE OF P.13. WATCH THE CENTER LINE, FIX IT AT MIDDLE.



STEP 20.



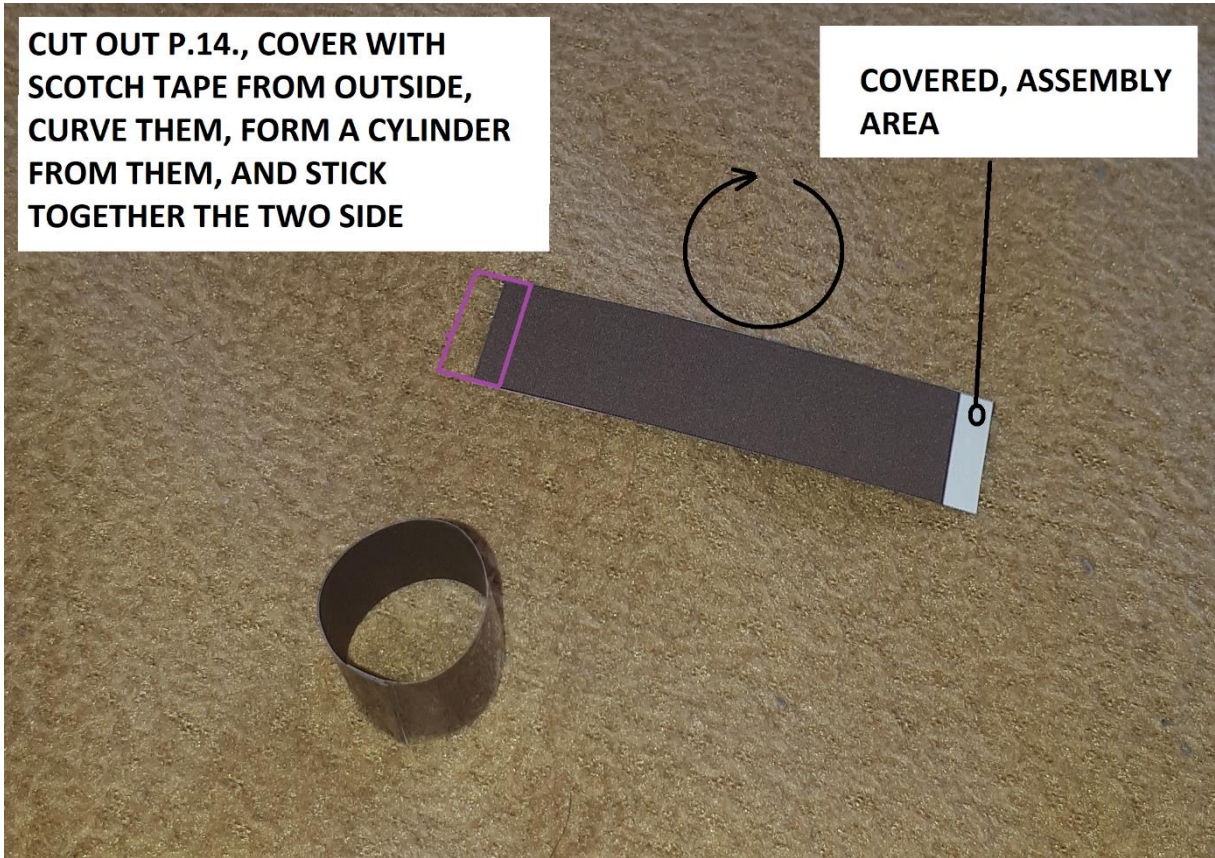
STEP 20.



STEP 21.

CUT OUT P.14., COVER WITH SCOTCH TAPE FROM OUTSIDE, CURVE THEM, FORM A CYLINDER FROM THEM, AND STICK TOGETHER THE TWO SIDE

COVERED, ASSEMBLY AREA

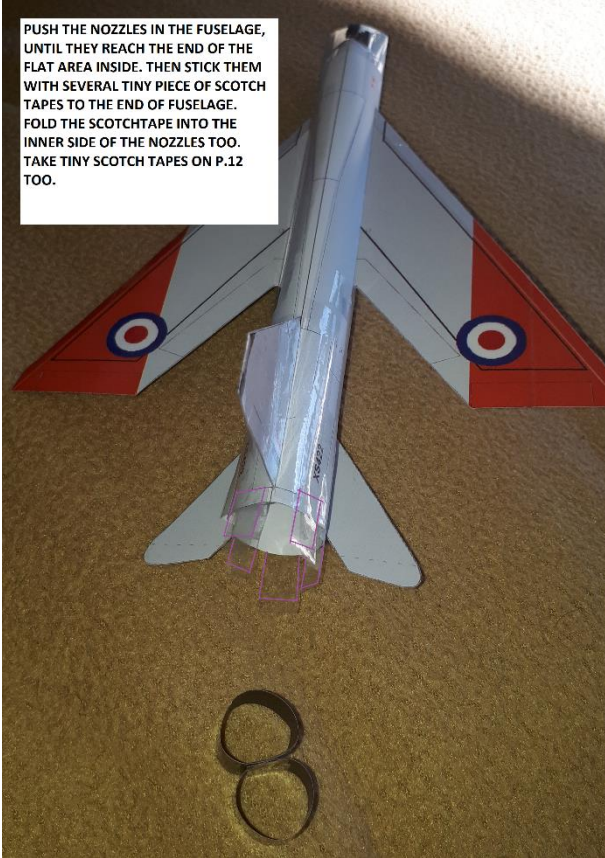


STICK THEM TOGETHER WITH TINY PIECE OF SCOTCH TAPES AT FORWARD AND AFT EDGES.



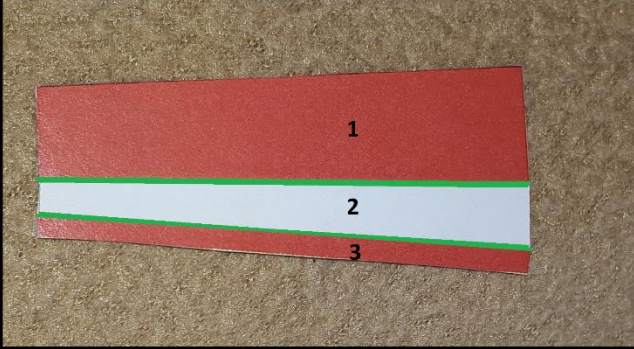
STEP 21.

PUSH THE NOZZLES IN THE FUSELAGE, UNTIL THEY REACH THE END OF THE FLAT AREA INSIDE. THEN STICK THEM WITH SEVERAL TINY PIECE OF SCOTCH TAPES TO THE END OF FUSELAGE. FOLD THE SCOTCHTAPE INTO THE INNER SIDE OF THE NOZZLES TOO. TAKE TINY SCOTCH TAPES ON P.12 TOO.

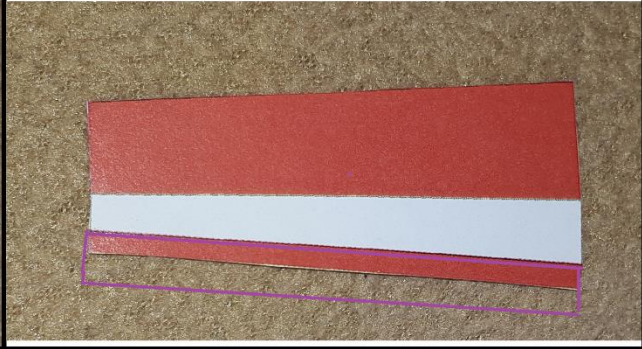


STEP 22

CUT OUT P.16. SCRATCH AND FOLD NEAR THE MARKED LINES. CURVE AREA 1. AREA 2 WILL STAND ON THE FUSELAGE. AREA 3 IS AN ASSEMBLY AREA, WHICH PARTIALLY COVER AREA 1



STICK TOGETHER THE TWO SIDE WITH SCOTCH TAPE AFTER YOU FOLD AND CURVED THEM.

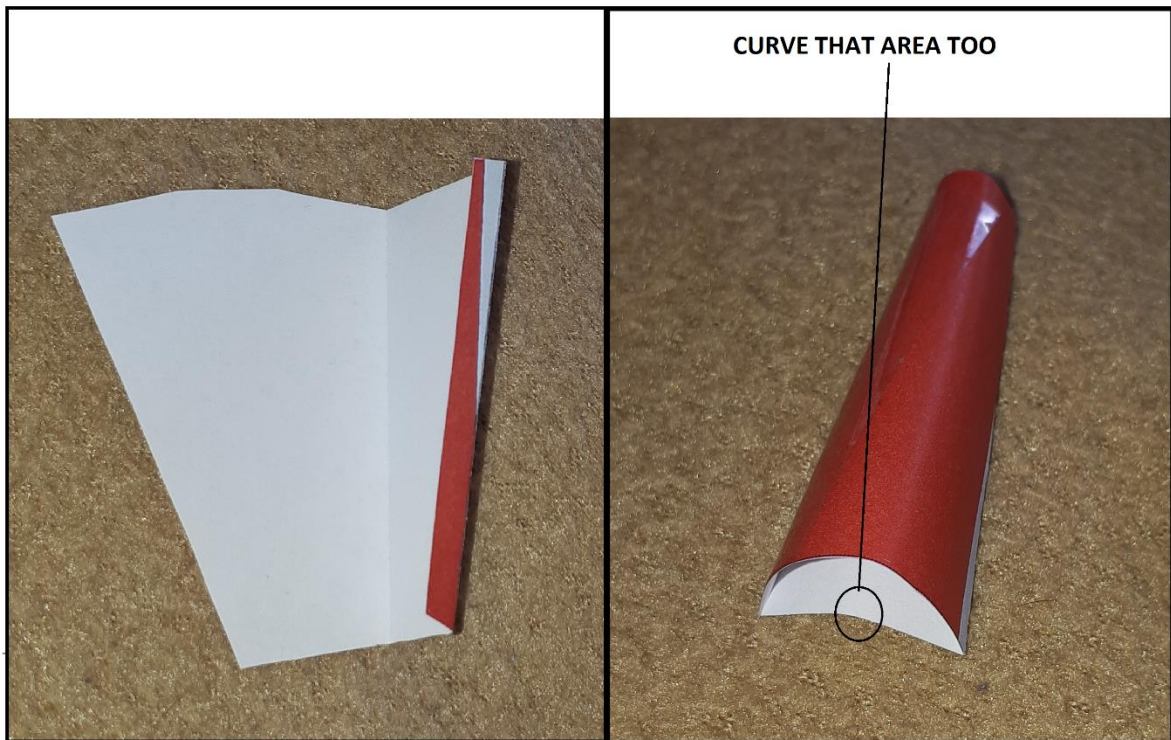


PLACE OF P.16. STICK P.16 THERE



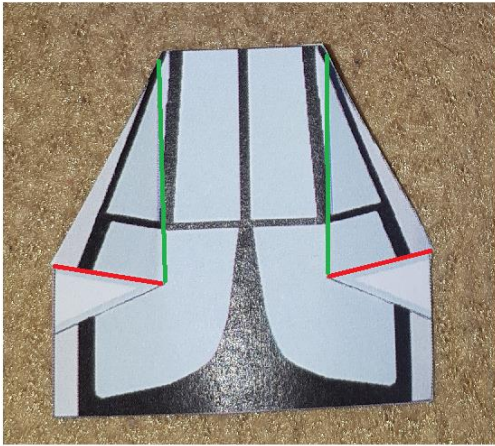
STEP 23.

MAKE EVERYTHING THE SAME ON P.17, AS YOU MADE WITH P.16. ALTHOUGH ON P.17, YOU HAVE TO CURVE THAT AREA, WHICH STAND ON THE FUSELAGE, TO FOLLOW THE FORM OF THE FUSELAGE AT ASSEMBLY.

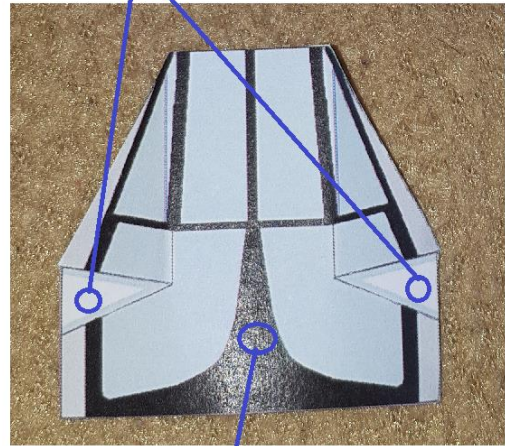


STEP 24.

CUT IN, SCRATCH AND FOLD P.18 AT THE MARKED PLACES.

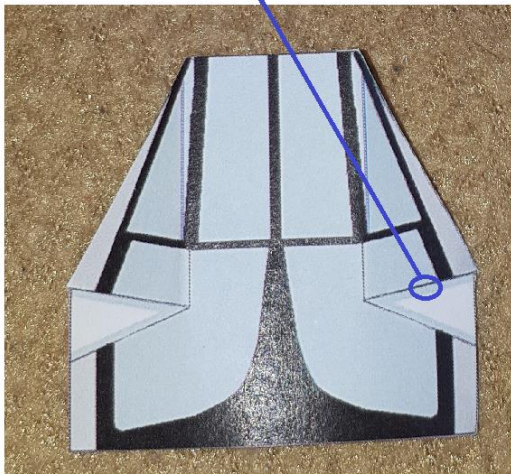


THIS AREAS ARE COVERED BY THE AREAS BEFORE THE CUT-IN.



CURVE THIS AREA

AFTER YOU CUT IN THIS LINE, PULL THIS EDGE NEAR THE REAR LINE, AND STICK THEM TOGETHER WITH SCOTCH TAPE ON EACH SIDE



STEP 24.

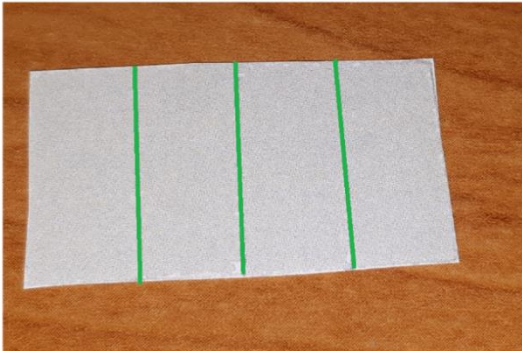
ADJUST THE CANOPY FORWARD EDGE TO THE AFT
EDGE OF P.13. TAKE THE AFT PART OF CANOPY ON
P.16. STICK THE CANOPY WITH SCOTCH TAPE TO THE
PLANE ON EACH SIDE. WATCH TO FIX IT AT MIDDLE.



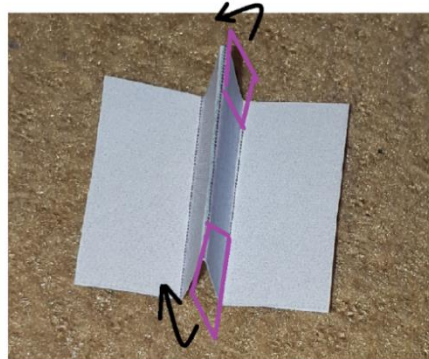
STEP 25.

IN THAT CASE, IF YOU WANT TO BUILD JUST A STATIC, NON FLYABLE MODEL, LET OUT THIS STEP.

CUT OUT P.19. THIS IS THE HANDLE. SCRATCH AND FOLD NEAR THE MARKED LINES. THEN COVER WITH SCOTCH TAPE.



STICK TOGETHER THE TWO HALF WITH SCOTCH TAPE.

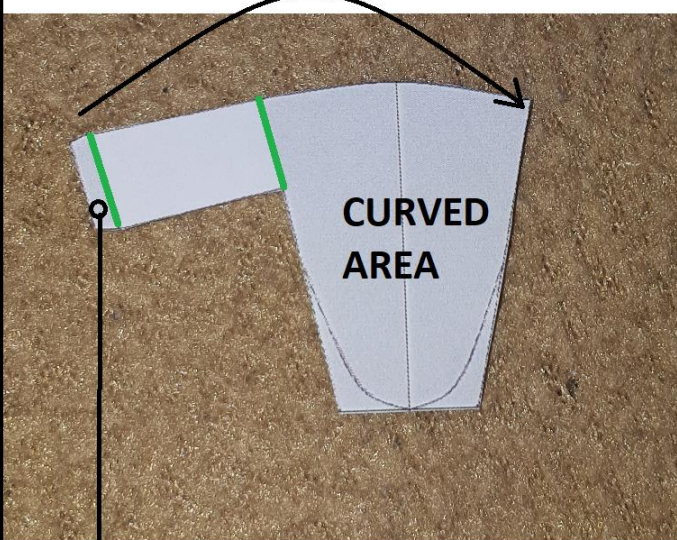


STICK THE HANDLE TO ITS PLACE WITH 4 PIECE OF ACOTCH TAPE AS YOU CAN SEE ON THE PHOTO. FIRST STICK P.19 WITH LONGITUDIAL DIRECTION SCOTCH TAPES TO THE PLANE, THEN STICK DOWN THIS FASTENING WITH CROSS-DIRECTION SCOTCH TAPES. IT IS VERY IMPORTANT TO FIX THE HANDLE WELL TO THE PLANE, OR YOU CAN EASILY COME OFF DURING THROWING.

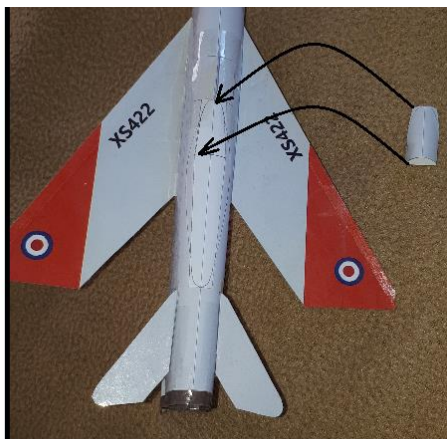


STEP 26.

SCRATCH AND FOLD P.20 AT THE MARKED LINES. CURVE IT, AND STICK TOGETHER WITH SCOTCH TAPE



ASSEMBLY AREA, WHICH PARTIALLY COVER THE CURVED AREA



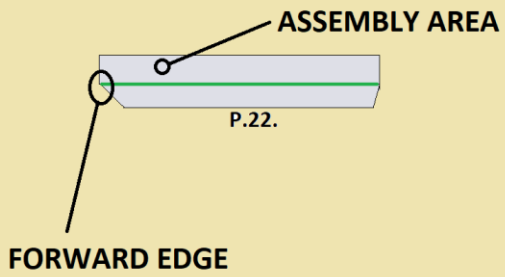
STEP 27.

CUT OUT P.21. CURVE IT AND STICK WITH SCOTCH TAPE TO IT'S PLACE. THE FORWARD EDGE OF P.21 IS STAND ON THE AFT EDGE OF P.20.

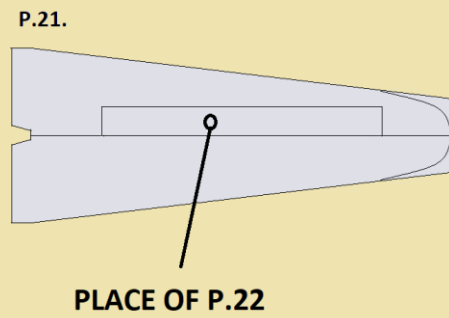


STEP 28.

CUT OUT P.22, SCRATCH AND FOLD NEAR THE MARKED LINE



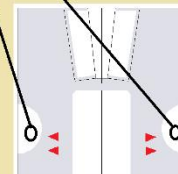
STICK P.22 TO IT'S PLACE WITH SCOTCH TAPE. KEEP IT AT MIDDLE.



STICK THE MARKINGS ON THE TWO SIDES OF THE FUSELAGE

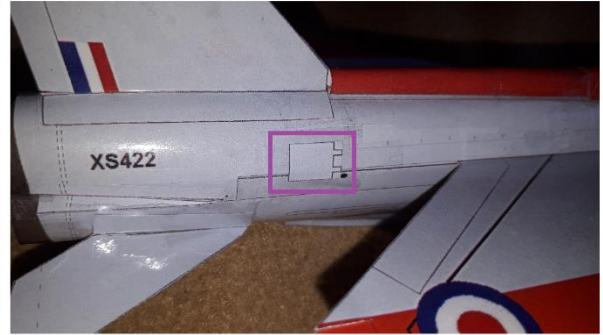


THIS AREAS SHOWS THE UPPER POSITION OF THE MARKINGS



STEP 28.

CUT OUT P.25, AND ADJUST IT'S LOWER LINE NEAR THIS LINE ON THE FUSELAGE. FIX IT WITH A PIECE OF SCOTCH TAPE. MAKE THIS ON EACH SIDE.



STEP 29.

Cover every outer surface with scotch tape. Use little pieces of scotch tape for this purpose.

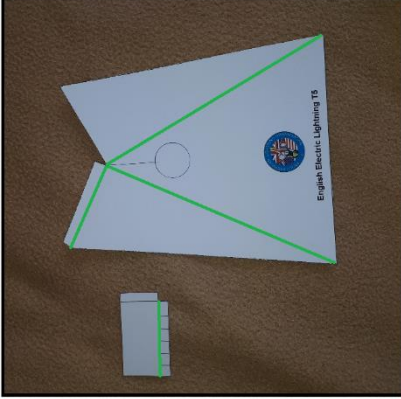
Stick a scotch tape on the leading edges of the wing and fold it on the edge. This will protect it during hard landings.



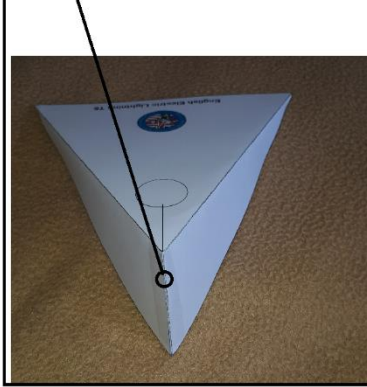
After this, fold down the leading edge in the same angle on each side, about 20-30 degree.

STEP 30.

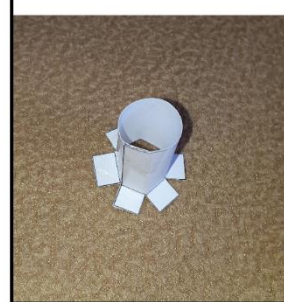
CUT OUT THE PARTS OF THE STAND, AND SCRATCH THEM AT THE FOLLOWING PLACES.



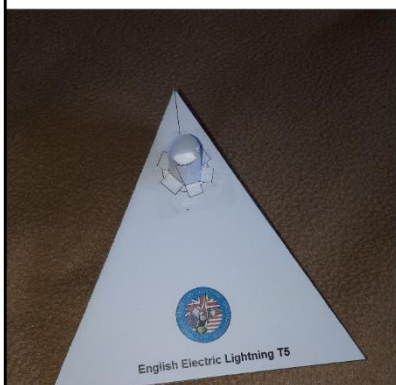
FOLD THE SIDES OF THE BIGGER PARTS, AND FIX TOGETHER WITH A PIECE OF SCOTCH TAPE AT THIS LINE



FORM A TUBE FROM THE SMALLER PIECE. BEFORE YOU STICK TOGETHER, TRY IT INTO THE UPPER ENGINE NOZZLE. IT'S DIAMETER HAVE TO BE SMALLER THEN THE NOZZLE. STICK IT TOGETHER AND FOLD UP IT'S "LEGS".



STICK IT TO THE BIGGER PIECE WITH SEVERAL SCOTCH TAPES.



Congratulations!

Your Lightning is ready for the first flight.



Method of flying, flight setups

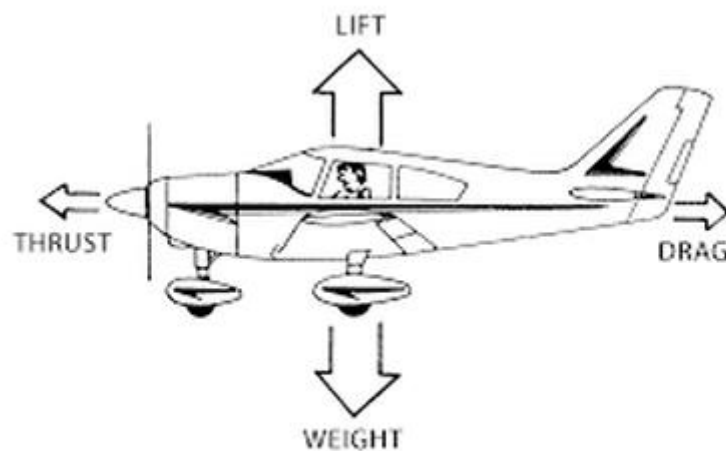
When you fly the plane, you usually have to setup the plane. You can find the ideal setups only at outdoor flight. You have to make several tries to find ideal balance and setups. Never judge only from one attempt.

I have got experience about flying the plane at flat terrain. I did not try to flying it from hill. Maybe it is required other launch techniques, if you want to do this, you have to make some own experiences.

If you want to fly successful the plane, you have to understand some of basic aerodynamics first.

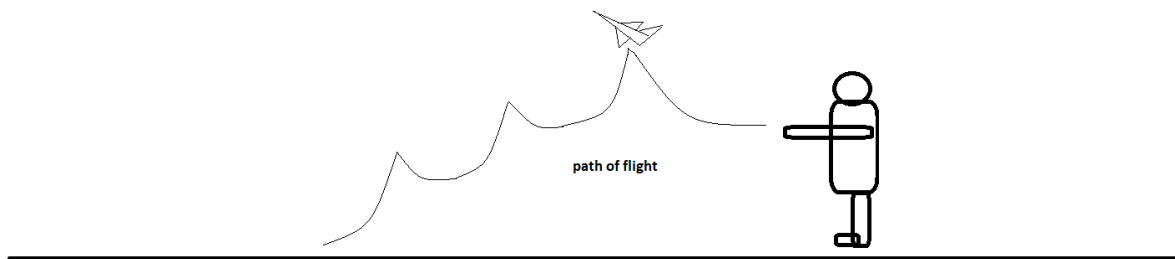
There are four main force during an airplane flying. lift, weight(gravity), thrust, and drag.

The thrust on this model is given by the hand-launch, and later, it gains the speed from gravity. It is important to keep at low the weight of the model, if weight is light, the liftpower can prevail better, which affects longer flights.



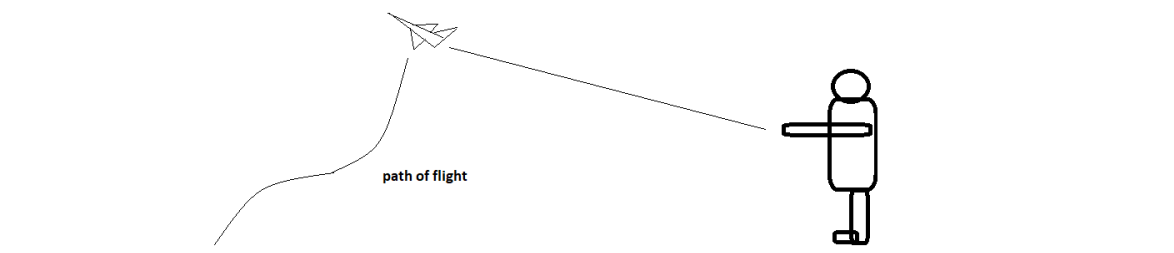
All of these forces are generated all along the plane, but we can find the resultant force if we sum all of this. The most important resultant forces for us will be the resultant lift force, and center of gravity. We have to keep them close to each other for stable flying. We can setup both of them. The correct position of center of gravity is very important. If it's far away from resultant lift power, this distance will work as a leverage, and will rotate the plane around the center of gravity. If the plane is rotated too high or too low against the stream, the airfoil will stop generate lift power. So we can find the ideal place of center of gravity, and we have to balance the plane with giving balance weight at the right places.

If the plane is a little bit noselight, it still can fly, although it will be a little bit „stumbling” in the air. Be carefull! Too much positive elevator setup can create similar moves.



To avoid this, stick some balance weight from PAGE 1 under the nose. (marked as P.24).

If the plane is nose heavy, it will flying high after a strong launch, but will glide only short, all fall down with forward the nose in the mud.



The model is tends to become noselight without additional balance weight, or is in good balance, but if you build it correctly, it should not be noseheavy. If you find the plane noseheavy with balance weight, remove some of them from the nose.

If you find the ideal place of center of gravity with balancing, the plane will glide with a straight leveling at a long distance. My experience is, when you think, you take enough weight under the nose and it is perfect, try to stick one, or a half more, and watch durring some flight the movements of the plane. Don't affraid to make some more experiment for

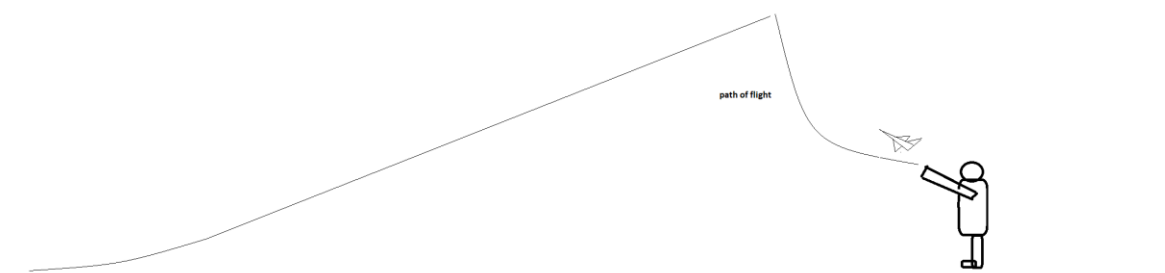
the best balance. For the first flights, bring yourself some balance weight and scotch tape, and if you feel necessary, use them.

The thoughts below are apply for a strong fast launch, as I launch my planes in my videos. Naturally you can launch at about it's optimal glide speed, which is good at a hill, but affect short flying at flat terrain.

The resultant lift force can increase and decrease, and can move along the airfoil some percent during flight. This depends on angle of attack and speed. Why is this important for us? The plane will make a „fix path”, with one kind of setup, with a kind of launch, at a kind of wind conditions. The setups of control surfaces are not changes on the model during the flying. We can set up it before the launch. The speed of the airplane will change during the flight. The speed will be the greatest in the moment of the launch. Later the drag and gravity will work against this, and the plane will decrease speed. If the speed of the flow around the wing is greater, there will be more lift power, so our model will climb high. During it gain altitude, the gravity and drag will work against this moving, so it will be decrease speed, decrease lift power, and will reach the highest point of it's flight path. At that point, it start to glide back to the ground. The thrust is generated by gravity, a speed of plane will be slower, and it will glide a long distance, if the flight setups and the center of gravity is good.

Because of this, the plane has a flight path, and you have to find the best launch angle, for the farthest flying. If you launch the plane in too low degree, it will not get enough altitude, or if you launch it vertical, the increased lift power will turn the plane back to the ground.

Launch always the model against the wind. This will increase the lift power, and the plane can climb higher. Only a very little wind can help a lot. Always find the wind direction before a throw. Naturally, in big wind, it is nearly impossible the launch well the plane.

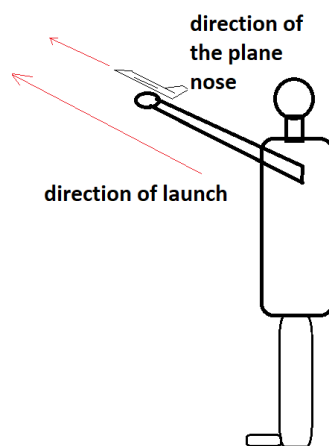


The flight path will be similar to this, although it will be higher and longer compared to the man and plane on the draw.

Keep strongly and fix the handle with your two finger durring the throw. You have to keep the whole handle, as close as possible to the fuselage.



The plane have to be in a neutral, or a very little positive angle of attack durring the throw.



Axes of Flight

On this picture, you can see the axes of flight. When you use any control surface, it makes changes one of these axes.

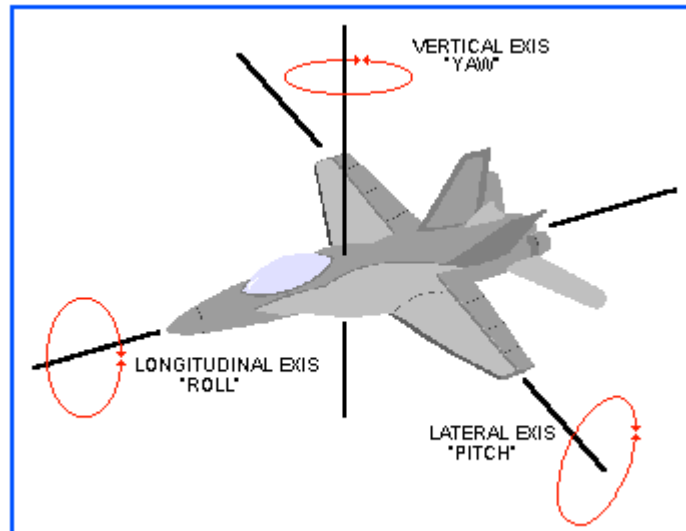


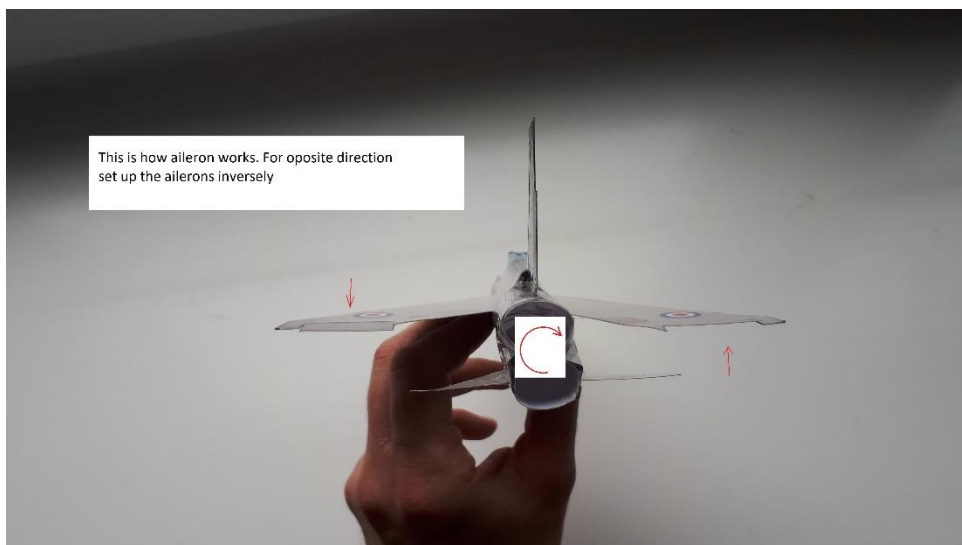
Figure 5-1 The axis of rotation.

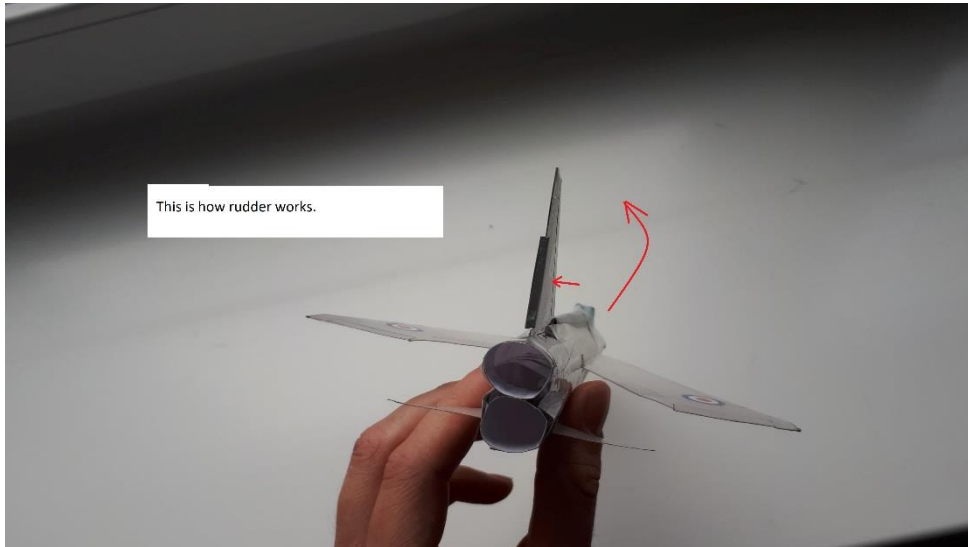
You have to setup control surfaces every time, when the model is not flying on a right path.

The elevators controls the movement along the lateral axis.

The ailerons controls the movement along the longitudinal axis.

The rudder controls the movement along the vertical axis.





When you use the control surfaces, usually a very little correction is enough. You don't need to fold the surfaces in big angles. If the airplane surfaces are symmetrical, usually enough as much correction as this:





A little bit more about lift power. How lift power created on our model? First of all, we need stream of air around the airfoil. This is created by the launch, and the gravity later. If the airfoil has angled against the flow, there will be difference in the pressures at the lower half of the wing and upper half of the wing. Near this, we folded down the leading edge, and give some curve for the airfoil, which help increase this pressure difference.

As we stick the elevator to it's place, it is in a positive position, it push down the aft of the plane, and takes the wings into the right angle of attack.

If there are bigger lift power at one of the wings, the plane will rolling. Always fold down the leading edges in the same angle on each side, or lift power can become assymetrical. Near this, avoid any kind of deformity of the plane.

Never take anything on the plane, while you storage it! If any part of the plane deformed, try to bend back and take symmetrical again!

The plane can fly only with clean and symmetrical surfaces.

I hope, you enjoyed the build, and you will spend some good time with your model.

If you have any question, need advice, perceive any fault or have any suggestion,
please contact me at peter.aircraft.factory@gmail.com

If you want to see my other designs subscribe to my youtube chanel,
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