

Engineering skills involve asking questions, imagining possibilities, and thinking creatively to solve problems. The engineering design process is a series of steps engineers use as they work to solve problems. There are five main steps:

**ASK IMAGINE PLAN CREATE IMPROVE**

In the airplane model project, your students will be provided the “PLAN” for making a model airplane. Their job will be to CREATE the model. Once they finish the model it is important that they think about ways they could IMPROVE the process or the design. This could mean that they would design a better PLAN and IMAGINE their own design for an airplane or other project.

## **Airplane Model Project**



### **STEAM: Engineering**

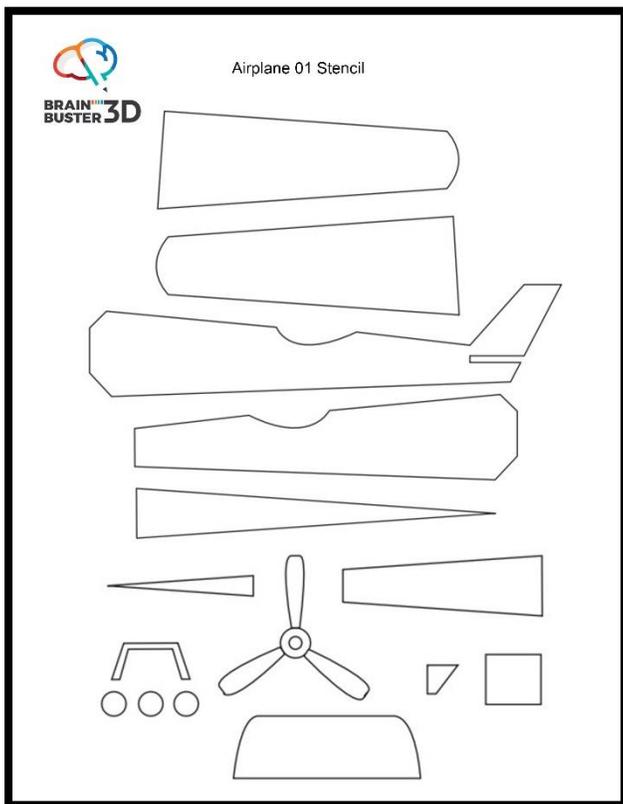
The engineering design process is a series of steps engineers use as they work to solve problems. There are five main engineering steps: **ASK IMAGINE PLAN CREATE IMPROVE**

**Building an Airplane Model will help your students learn Engineering Skills. How?**

- They will use a stencil which is their PLAN to create each part of the airplane.
- They will need to arrange the parts of the airplane as they would a puzzle, and determine which parts need to be welded together to CREATE the 3D form of the airplane.
- When they finish the model, help your student to think about ways they could IMPROVE the process or design.
- ASK your students to IMAGINE how they would PLAN and CREATE their own design for a 3D airplane model.

**Materials Needed:** Airplane 01 Stencil (Page 8), 3D Pen, 2-3 colors of PLA filament, scissors silicon thumb & finger protectors, a paper towel or napkin.

**Optional: To keep the stencil intact, place it in a plastic sheet protector.**



## BRAIN BUSTER 3D Art Pro Plus Kit Contents



AC/DC Adapter & USB



Thumb & Finger Protectors



3 Pack of PLA Filament



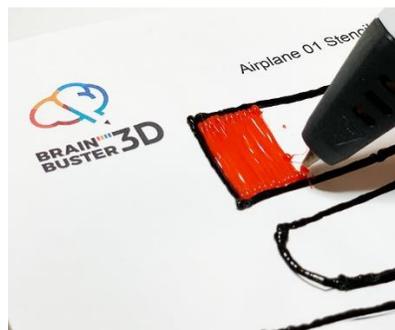
Plastic Tool



Art Pro Plus  
3D Printing Pen

## STEP by STEP INSTRUCTIONS for TEACHERS:

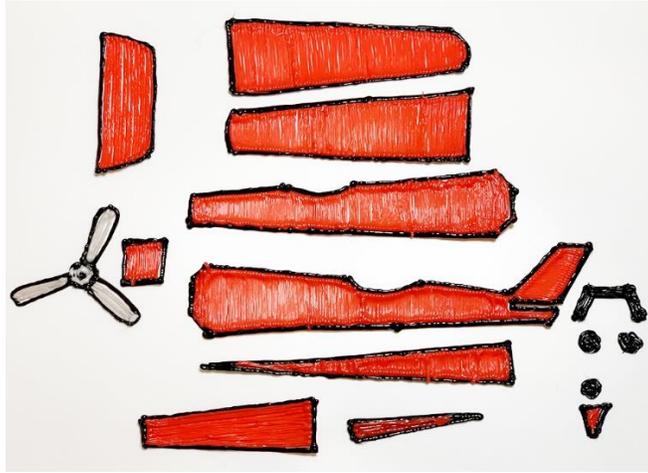
### STEP ONE:



Make a copy of the Airplane 01 Stencil. If you need directions about how to operate a 3D pen, please refer to the **Teacher 3D Pen Operator Guide**. Once the 3D pen is heated and loaded with filament, direct your students to find a starting point on the stencil to anchor the filament. They will then move the 3D pen along the lines to outline each part. Once all the parts are outlined, they will fill in each part by moving the 3D pen back and forth between the outline they made.

They can select any color of filament to create their airplane model. If they do not like the PLA filament colors that they have, they can paint the parts with acrylic paint before they remove them from the stencil or paint their finished airplane model.

## STEP TWO:



If your students use a plastic sheet protector, the parts should peel off the stencil easily. If they made the parts by extruding the filament directly on the paper stencil, some of the paper will stick to the back of the parts they made. To remove the paper, rinse the plastic parts with warm water and dry them with a paper towel.

Arrange the parts as they would a puzzle to see which ones will need to be welded together to form the 3D airplane model.

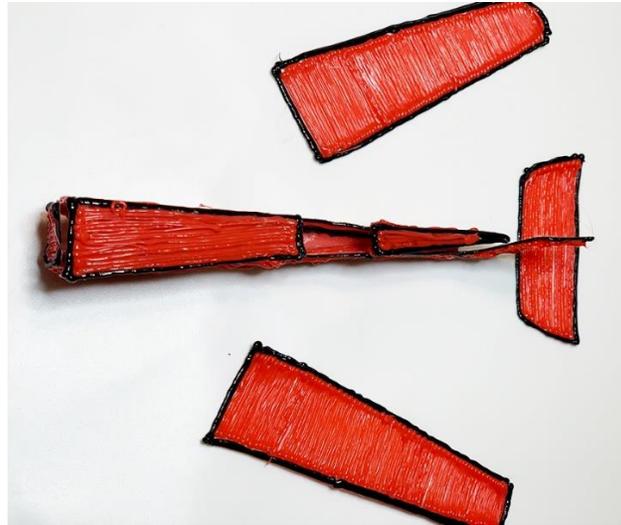
## STEP THREE:



It is time to weld the body of the airplane together. This is challenging. Take the larger triangle. Notice that the larger end of the triangle should be welded to the front of both side panels with the small end of the triangle tapering towards the back. Weld from the inside of the model whenever possible. Once they have welded these three parts together, take the shape as shown above right and weld it to the top front of the airplane. The smaller end towards the cockpit and the larger end towards the nose of the plane. Take the small triangle as pictured below and weld the bigger end of the triangle just behind the cockpit and have the narrow end of the triangle taper towards the tail.



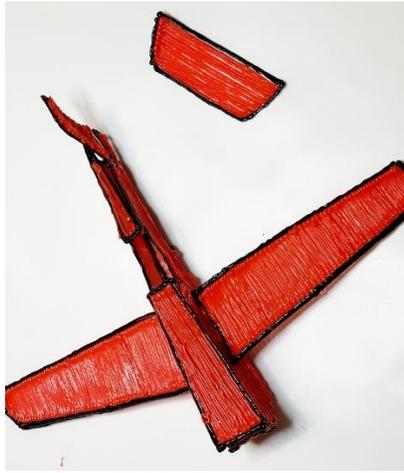
## STEP FOUR:



To weld the wings to the airplane, the tip of the 3D pen is used to melt the plastic on the side panel one at a time. While the melted plastic is pliable, quickly hold the wing firmly to the area. Once they have attached the wing, flip the airplane upside down and reinforce the wing by welding the seam. Repeat the process for the second wing.



## STEP FIVE:



To attach the tail, slide it into the notch at the back of the airplane and weld it in place.

### STEP SIX:



Weld the tire to the triangular part. Once the two pieces are welded together, attach the part to the underside of the plane near the tail and weld it securely in place as pictured above.

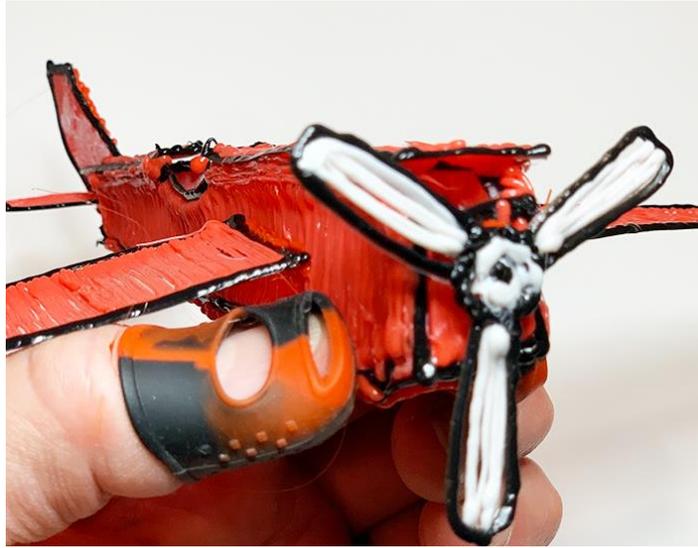


Weld the two wheels to the brace as pictured above to create the landing gear. Once the landing gear is welded together, attach it to the underside of the plane near the front and weld it securely in place.

## **STEP SEVEN:**



On the front panel of the airplane, use a circular motion with the 3D pen and extrude a drop of filament. Once the drop hardens, weld the propeller to it. Your child may need to weld around the edges to reinforce it.



### **Extend the Learning:**

- When they finish the model, direct students to think about ways they could IMPROVE the process or design.
- ASK students to IMAGINE how they would PLAN and CREATE their own design for a 3D airplane model.

For instructions on shutting down the 3D pen how to store it for future projects, refer to the

***Teachers 3D Pen Operators Guide.***



**BRAIN  
BUSTER 3D**

# Airplane 01 Stencil

