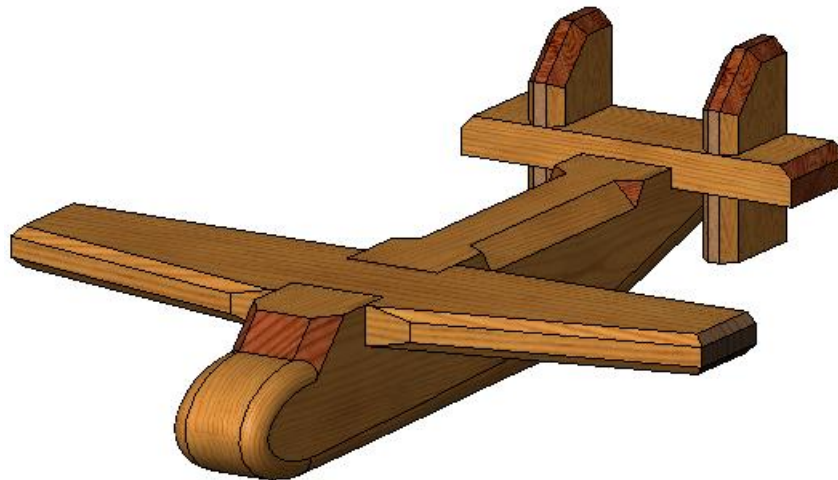


AEROPLANE



Prerequisite Knowledge Previous knowledge of the following commands is required to complete this lesson. **Sketching** (Line, Rectangle, Arc, Add Relations, Dimensioning), **Extrude**, **Assemblies** and **Creating a drawing from Part/Assembly**.

Focus of the Lesson On completion of this lesson you will have used:

- **Cut Extrude** with a line.
- Edit **Appearance**.
- **Variable Fillet**.
- Created an **Assembly**.
- **Mate** with planes.
- **Exploded view** of an assembly.
- **Animation** of exploded view

Commands Used This lesson includes **Sketching** (line, circle, arc, ellipse Smart Dimension), **Cut Extrude** with a line, **Add relations**, **Appearance**, **Variable Fillet**, **Assemblies**, **Mates**, **Exploded View**, and **Animation**.

Getting started Create a **New Folder** in your chosen location called ‘**Aeroplane**’.

The four parts that make up the project will be saved here.

Part One – Aeroplane Body

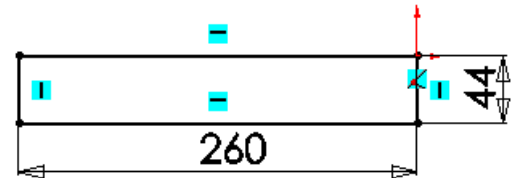
Open **New Part** from the **SolidWorks Document** dialog box.
Select **File**. Click **Save as** on the standard toolbar. Save as “**aeroplane body**”.
in the “**Aeroplane**” folder.

Continue to save periodically throughout the exercise.

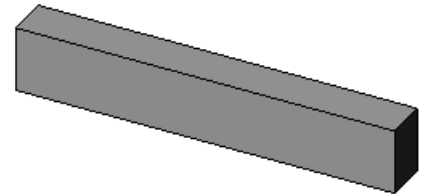
Create sketch

Create a sketch on the **Front Plane**
using the dimensions shown.

Confirm the sketch.



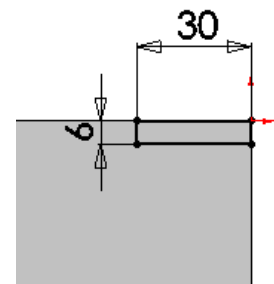
Extrude the sketch to a **depth** of
30mm. Use **Mid Plane** End Condition.



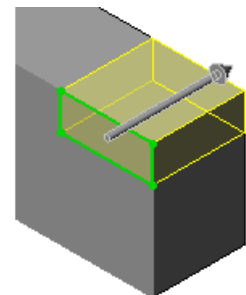
Rename the extrusion as “**Main Body**”.

Sketching recess for Back Wing

On the **front face** draw the **Rectangle** shown.
Add the dimensions shown to fully define
the sketch.



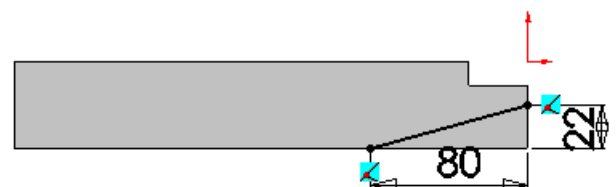
Exit the sketch.
Select **Extrude Cut, Through All**.



Sketching the Sloped Tail Section

On the **front face** draw the **line** shown
to the following dimensions.

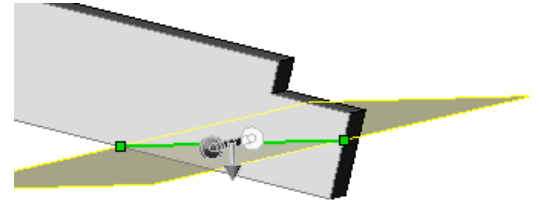
Confirm the sketch.



Select **Extrude Cut** and **Through All**

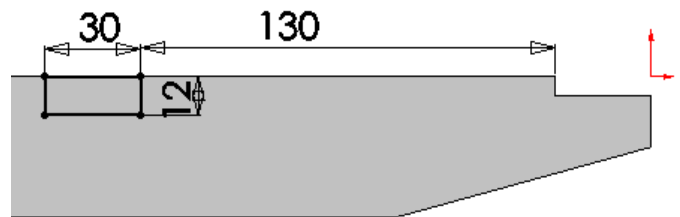
Flip the side to cut if necessary.

Rename Extrusion as “**Underside**”.



Sketching Recess for Front Wing

Draw the **Rectangle** to the dimensions shown on the **front face**.



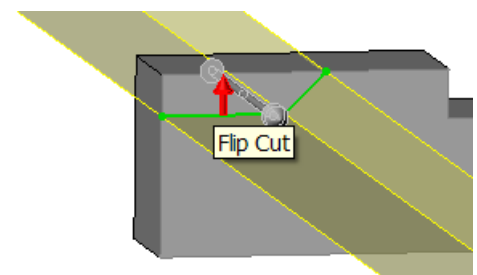
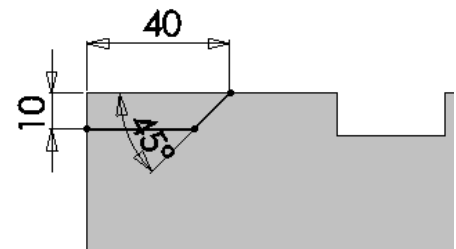
Extrude cut, Through all as before.

Sketching Front Screen.

On the **front face** sketch the profile to the dimensions shown.

In the feature manager select **Extrude Cut, Through all**.

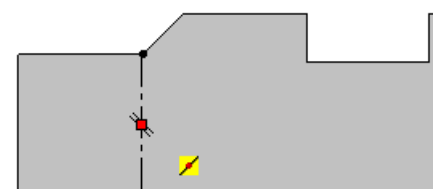
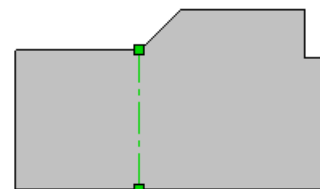
Flip the side to cut if necessary.



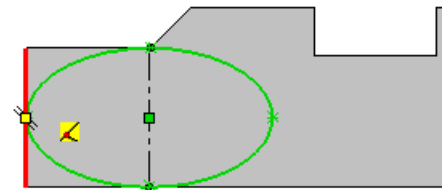
Sketching the Nose Section

Using the **Centerline** command draw the line as shown.

Select the **Ellipse** command and select the **Midpoint** of the centerline as the centre of the ellipse.

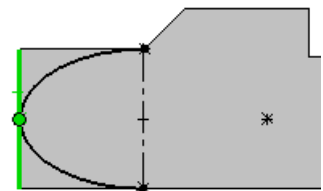
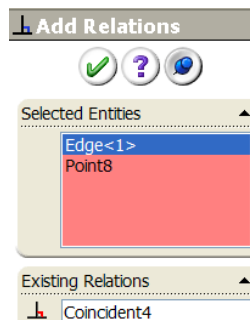


Select the minor and major axis as shown.



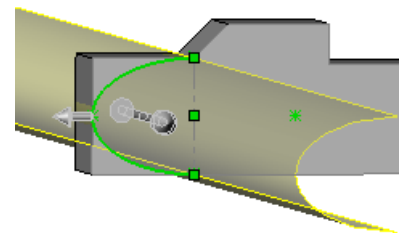
Use the **Trim** command to remove the unwanted portion of the ellipse.

Using **Add Relations** make the line and end of the major axis coincident, to fully define the sketch.



As before select **Extrude Cut** and **Through all**.

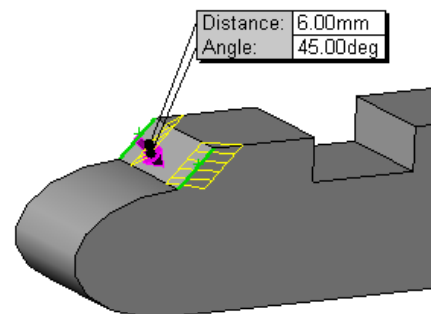
Flip the side to cut if necessary.



Rename the extrusion as **Nose Section**

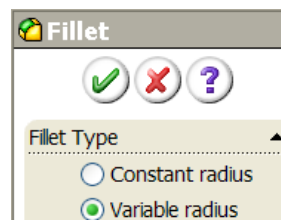
Shaping front section

In the feature manager select **Chamfer** and apply a **6mm** chamfer to the edges shown.

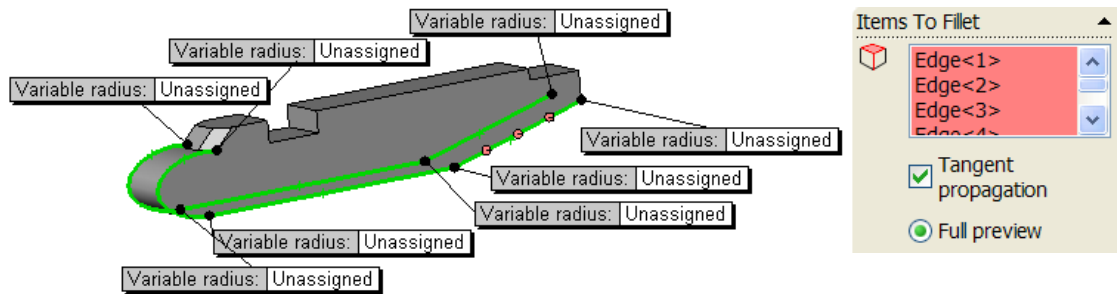


Applying Fillets

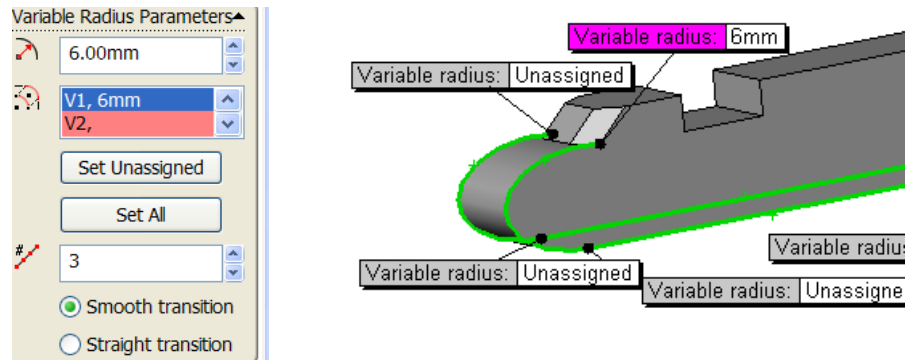
Select **Fillet** and select **Variable radius** as shown.



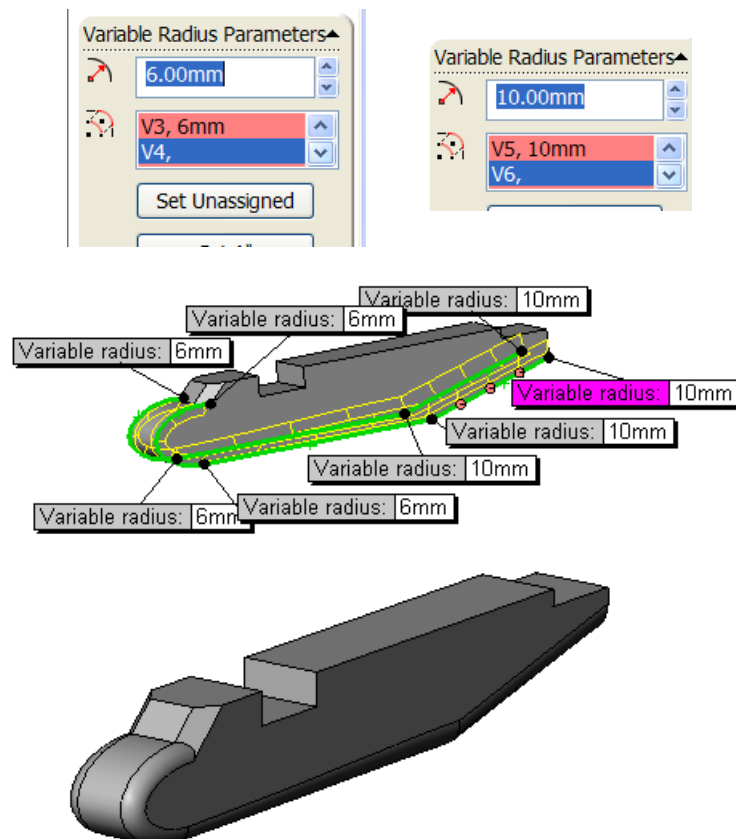
Select the edges to fillet as shown.



In the variable windows parameter box select Variable radius1 (V1) and type a radius of **6mm** as shown.



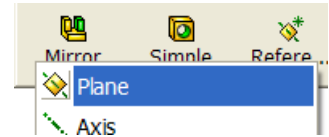
Select the next chain of edges and give them the following radii.



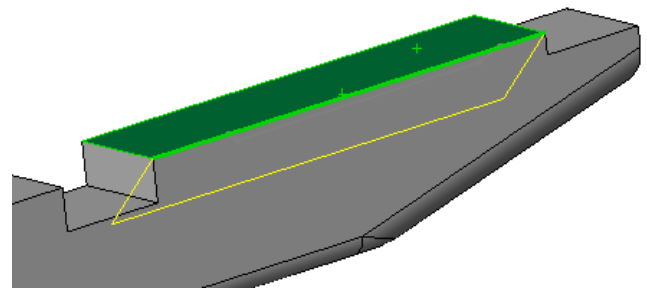
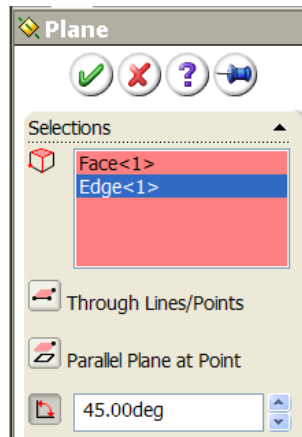
Applying the Stopped chamfers

Step 1 Set up a plane perpendicular to the chamfer

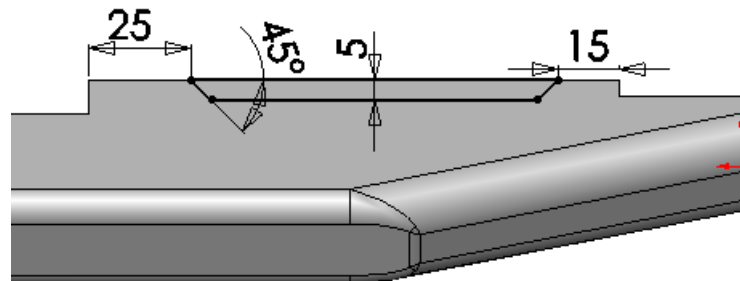
Select **plane** under **Reference Geometry**



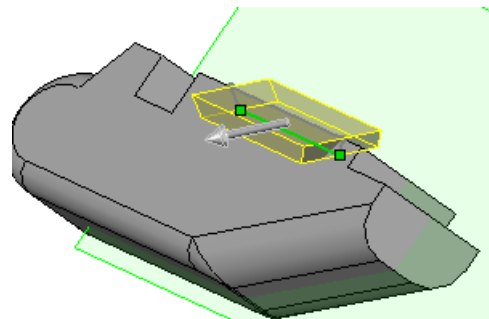
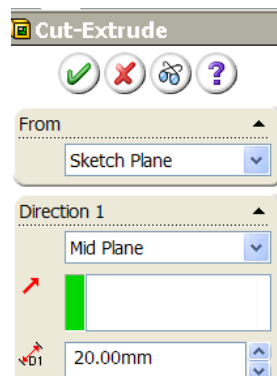
To draw the plane at the required angle, select the top face and the edge to be chamfered. Change the angle to **45 degrees** as shown.



Step 2 Draw the profile on this plane to the dimensions given.



Step 3 Select **Extrude Cut** as shown



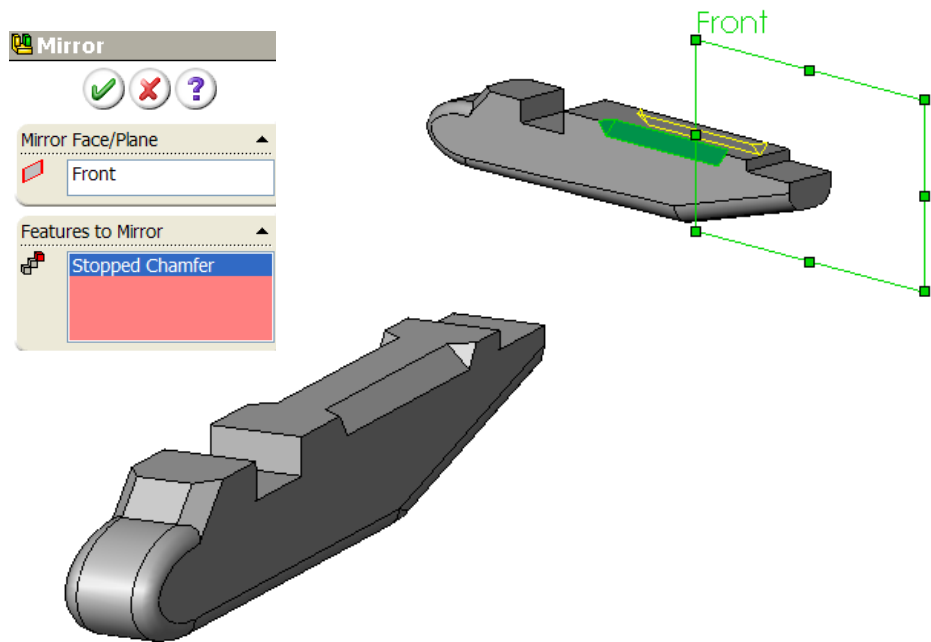
Rename the extrusion as “**Stopped Chamfer**”

Mirroring the Stopped Chamfer

Select **Mirror Components**

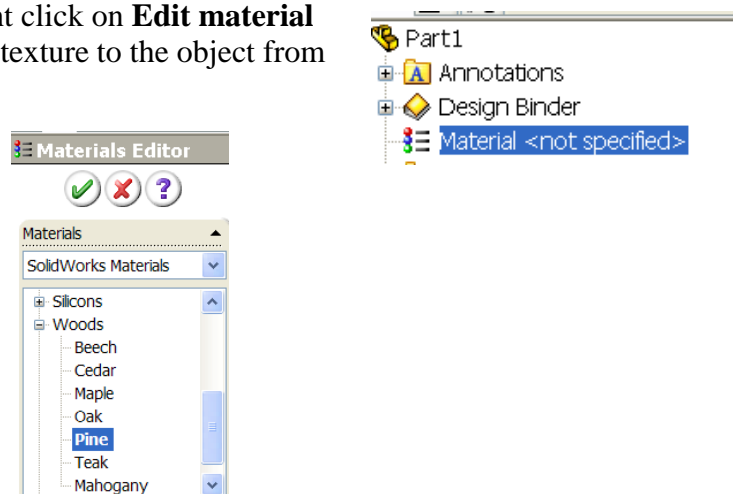
Select the **Front Plane** from the design tree, as the mirror plane.

Select Stopped chamfer from the design tree as the feature to mirror.



Edit Material

In the design tree right click on **Edit material** shown. Apply a **pine** texture to the object from the **wood** menu.



Apply a **grain 2** texture to the faces that contain end grain.



Save

Part two - Front Wing

Open **New Part**

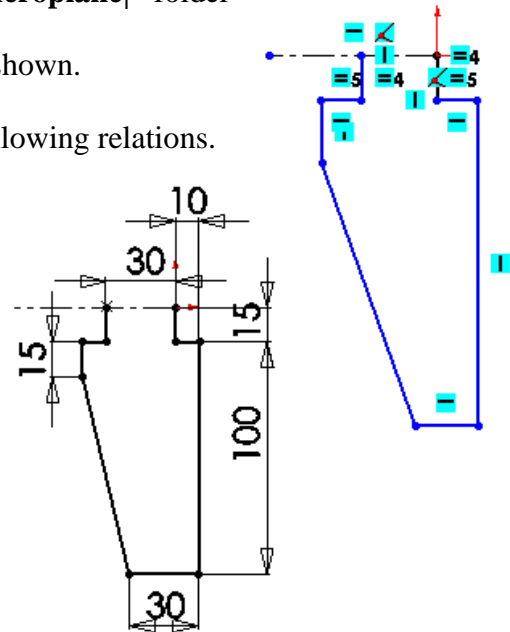
Save part as “**Front wing**” in the “**Aeroplane**” folder

Sketch

Sketch on the **Top Plane** the shape shown.

Draw the **Centerline** and add the following relations.

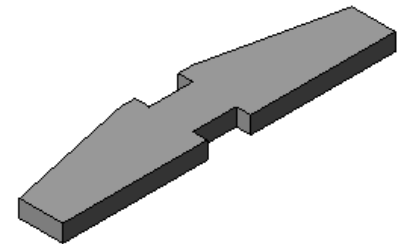
Add the following dimensions.



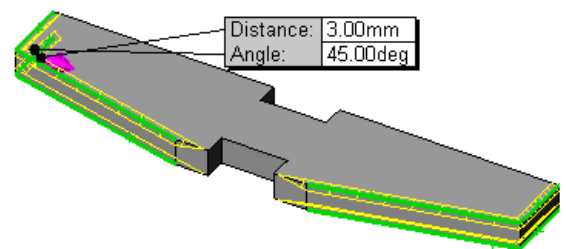
Select **Mirror** and mirror about the centerline.

Accept the sketch and **Extrude** by **12mm**.

Rename the extrusion as “**Front wing**”.



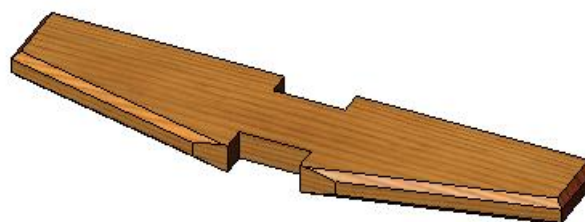
Select **chamfer** and apply a **3mm** chamfer to the four edges shown.



Edit Material

Apply a **pine** texture to the wing.

Apply a **grain 2** texture to the end grain.



Save the part

Part three - Horizontal Tail Wing

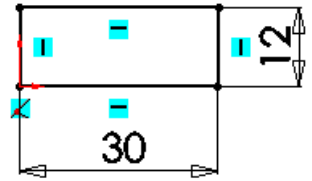
Open **New Part**

Save part as “**Horizontal tail wing**” in the “**Aeroplane**” folder.

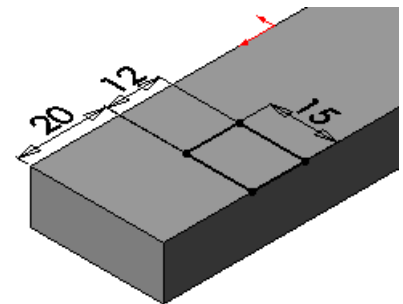
Sketch

Sketch a **Rectangle** on the **Front Plane** as shown.

Extrude using **Mid Plane** a distance of **110mm**.



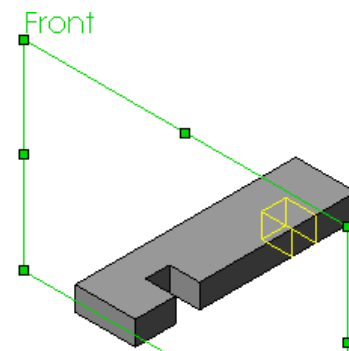
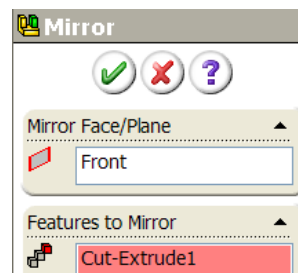
On the top surface draw the rectangle to the measurements given.



Accept the sketch.

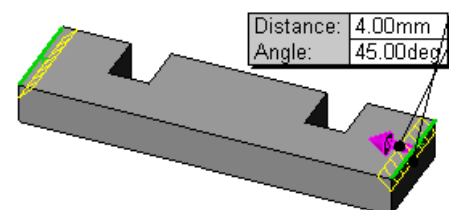
Extrude cut the rectangles **through all**.

Mirror the feature about the **Front Plane** as shown.



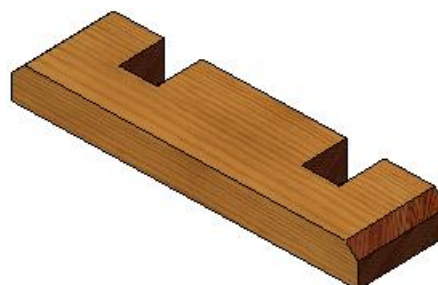
Accept.

Apply a **4mm** chamfer to the following edges.



Edit Material

Apply a **pine** texture to the part
Apply a **grain 2** texture to the end grain.



Save the part.

Part Four - Vertical Tail Wing

Open New Part

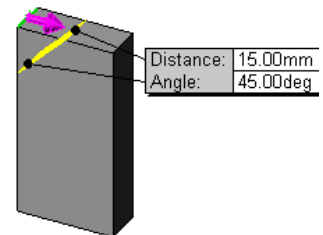
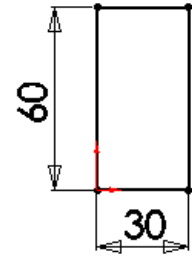
Save part as “**Vertical tail wing**” in the “**Aeroplane**” folder.

Sketch

On the **Front Plane** sketch the **Rectangle** to the following dimensions.

Extrude by **12mm**.

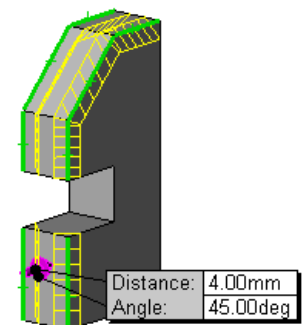
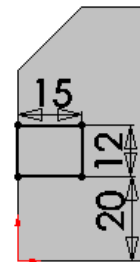
Apply a **Chamfer** of **15mm** to the top edge.



Sketch another **rectangle** on the front face.

Extrude cut, Through all.

Apply **4mm chamfers** to the following edges.



Edit Material

Apply a **pine** texture to the part

Apply a **grain 2** texture to the end grain.



Save the part.

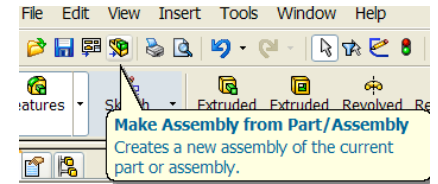
Aeroplane Assembly

The part files for this assembly are saved in the folder titled “Aeroplane”.


Open an existing part

Open the part called “Aeroplane body”.

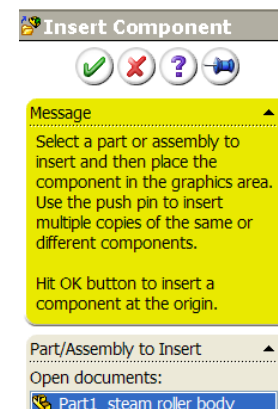
Click **Make Assembly from Part/Assembly**.



Insert component dialog box appears with “Aeroplane body” displayed.

Click on  in the property manager.

The part origin will snap to the origin of the assembly.



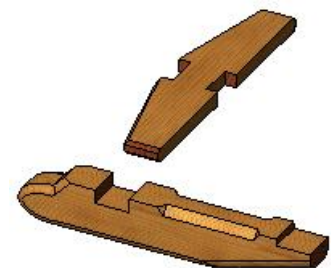
Save Select **File, Save as** on the standard toolbar.
Save the assembly as “Aeroplane Assembly” in the same folder as its parts.

Adding Component


Select **Insert component**  from the **Assembly** toolbar.

Choose **Browse** from the **Insert Component** dialog box.

Choose “**Front Wing**” and click in the graphics area to place it in as shown.



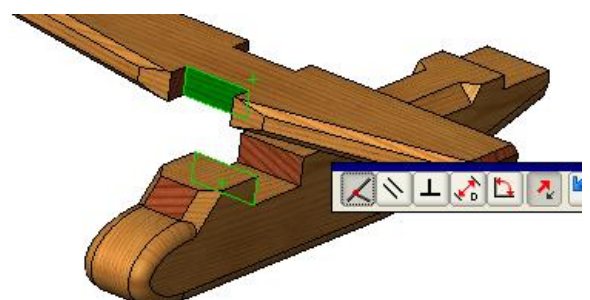
Insert Mates

Select the mate toolbar .

Mate the front face of the trench on the aeroplane body with the bottom of the trench on the wing.

A **Coincident Mate** will be selected by default.

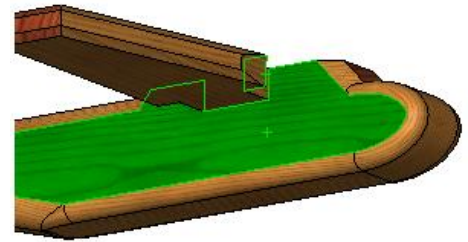
Accept.




Mate the bottom of the trench on the body with the underside of the wing.

Accept

Finally mate the side of the body with the side of the trench on the wing

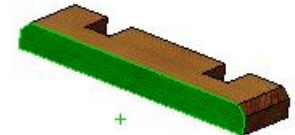


Accept

Select OK  again to exit the property manager.

Adding Further Parts

Select **Insert Component** from the assembly toolbar.
Choose the “**horizontal tail wing**”.



Insert Mates

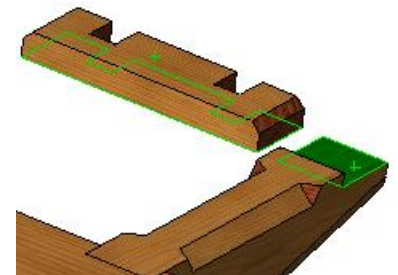
Mate the front of the horizontal tail with the shoulder shown



A **Concentric Mate** will be chosen by default.

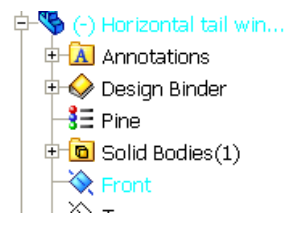
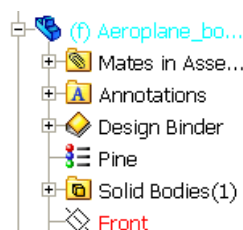
Accept this mate.

Mate the underside of the tail wing with the recess

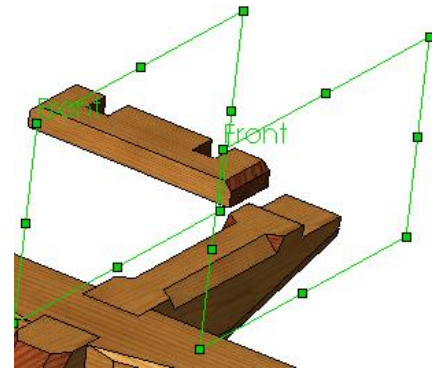


Additional Mates

The horizontal tail wing has to be centered on the plane body
One way to do this is as follows.
Expand the design trees of the two parts and mate the **Front planes** of each as shown..



A coincident mate is selected
by default



Accept the mate.

Select **OK** again to exit the property manager.

Adding Vertical Tail Wing

Select **Insert Component** from the assembly toolbar
Choose the “**Vertical tail wing**” and drag it into position.

Insert Mates

Mate the bottom of each trench.
Accept.

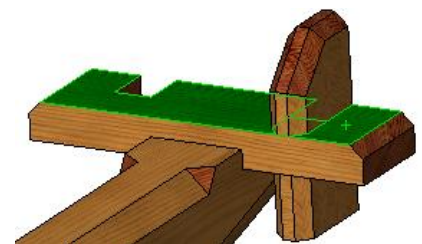


Mate the side of the vertical tail with the side
of the trench on the horizontal wing



Accept

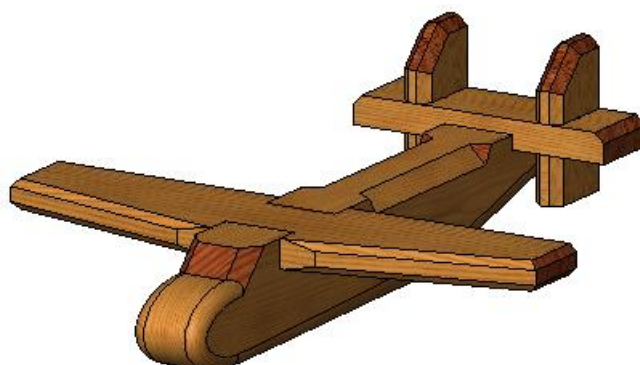
Mate the side of the trench on the vertical tail
with the side of the horizontal wing



Accept.

Select **OK** again to exit the property manager.

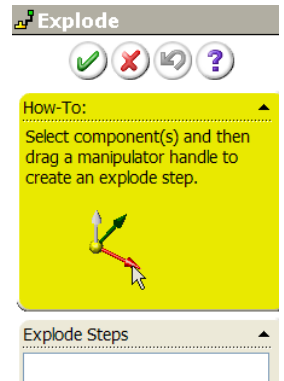
Follow the process again to insert the other vertical tail wing.



Exploded View

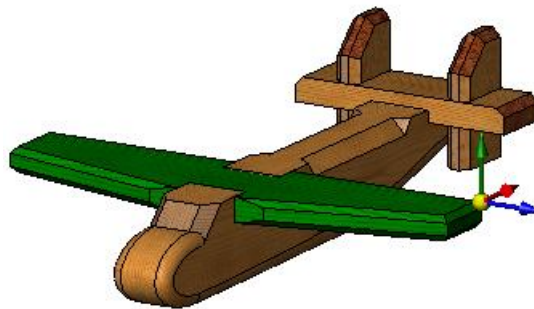
Click the **Exploded View** button  on the Assembly toolbar.

The Exploded view dialog box appears.



Exploding Front wing

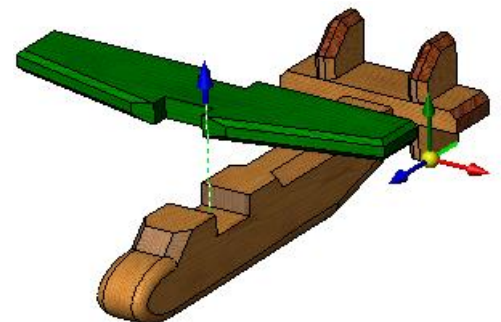
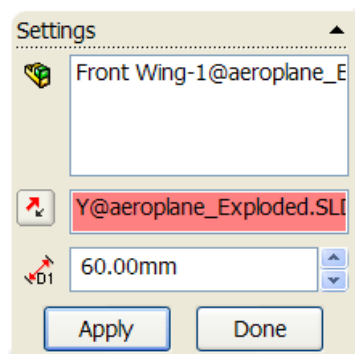
To move the front wing, select it as shown




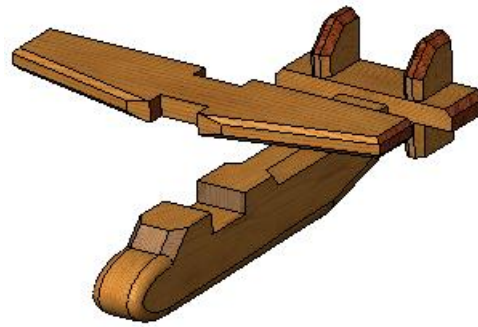
Explode View

Explode by one of two methods:

- 1) Dragging the relevant arrow (in this instance the green one) to the required distance.
- 2) By scrolling down the explode property manager and selecting the part to explode as shown.
Select the direction (**x, y or z**) by clicking the relevant arrow, and insert the distance
Select **Apply** to preview the selection.
Select **Done** to accept.



Select **ok**  to exit the property manager.



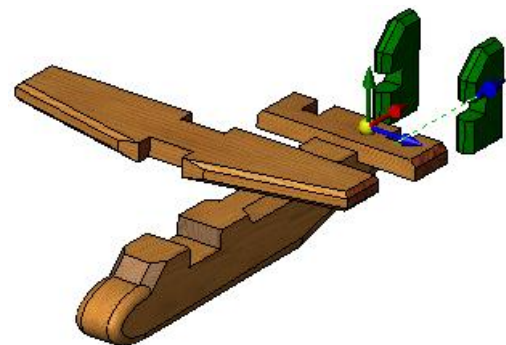
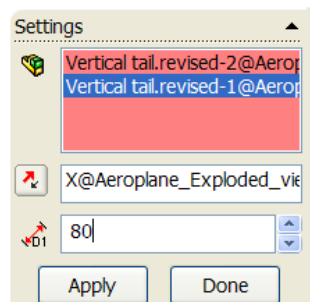
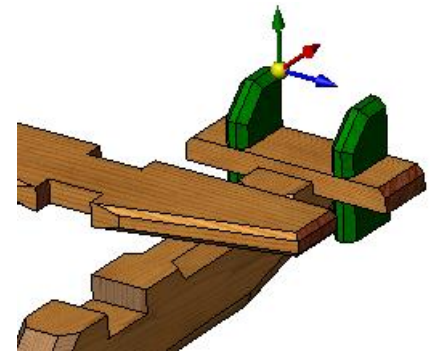
Exploding the Vertical Tail Wings

Select the **Explode View** button again.

Select the two vertical tail wings.

The move manipulator arrows appear.

Select the **X direction arrow** and drag outwards or insert a distance of **80mm** as shown.



Accept

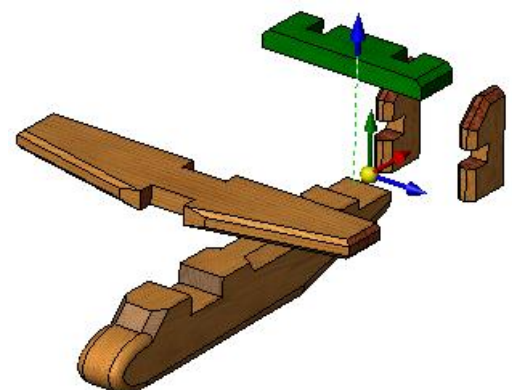
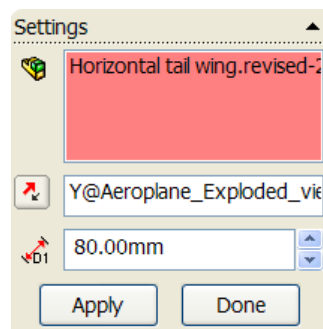
Explode the Horizontal Tail Wing

Select **Exploded view** as before.

Select the horizontal tail wing.

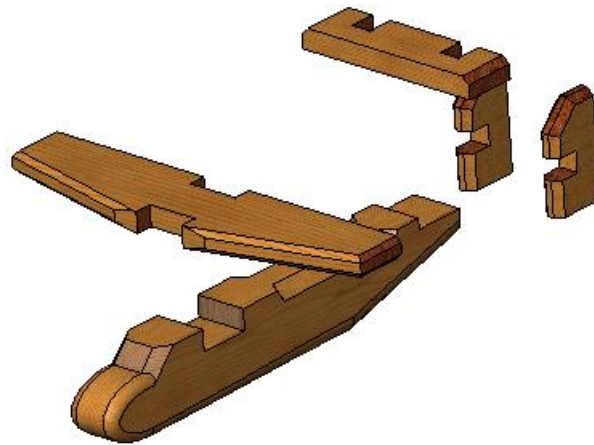
Drag the **green arrow** away from the assembly.

Insert the distance of 80mm.



Click Apply and Done.

Accept

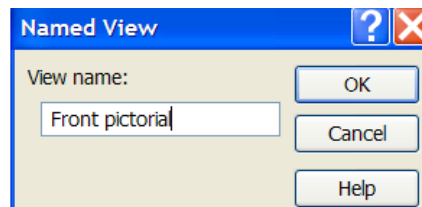
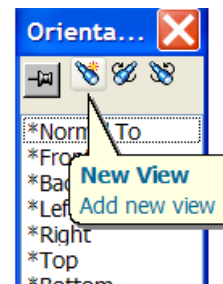


Saving the desired Exploded view

Press the space bar to show the **Orientation** dialog box.

Select **New View** as shown.

Name it as “Front Pictorial”

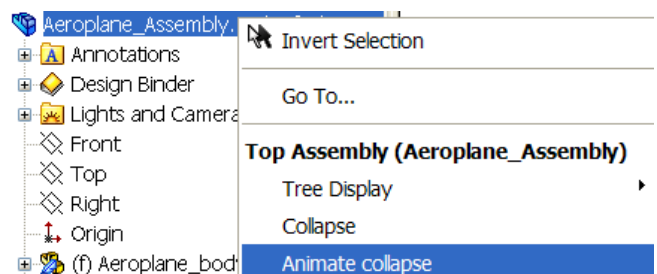


This view is now added to the list of views.

Animating the Exploded View

The Animation Controller can be used to animate the **explode** or **collapse** motion.

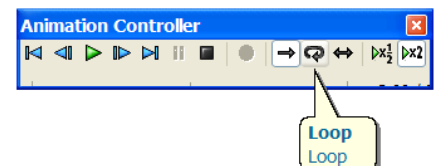
Right click on **Aeroplane Assembly** as shown and select **Animation collapse**.



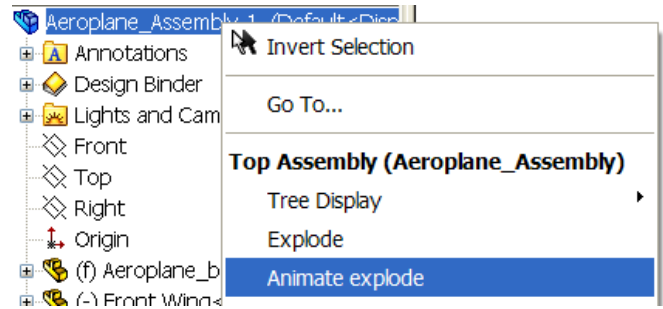
The animation controller display appears.

Select **play** or **loop**.

The Collapse motion will be shown.



To show the **Animation Explode motion**,
Select the animation explode in the same way.



Save

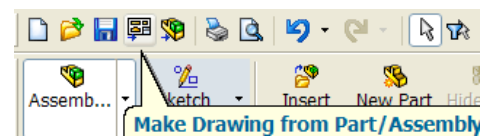
Save “AEROPLANE ASSEMBLY” in the **Collapsed View**

Creating the Drawing



To make drawing from Part/Assembly see the notes on
“Creating Drawings” from R6 in-service.

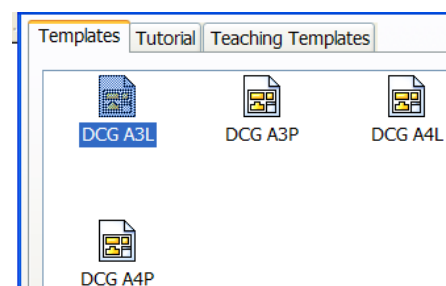
Click on **Make Drawing** in the
Standard Icon Toolbar as shown.



**Choosing a Drawing
Template**

Select the **A3L** template

Select OK

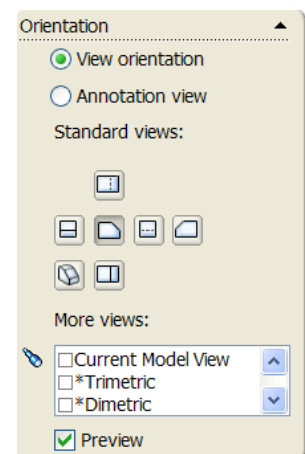


Model View

The **Model View** property manager is displayed

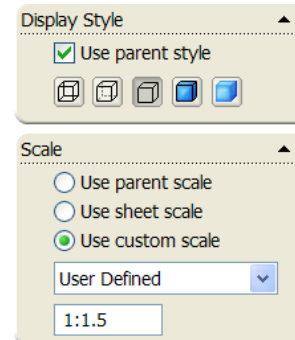
In the property manager make sure the front view
is selected.

Tick the preview button.



Scale

Set the scale to **1:1.5**.



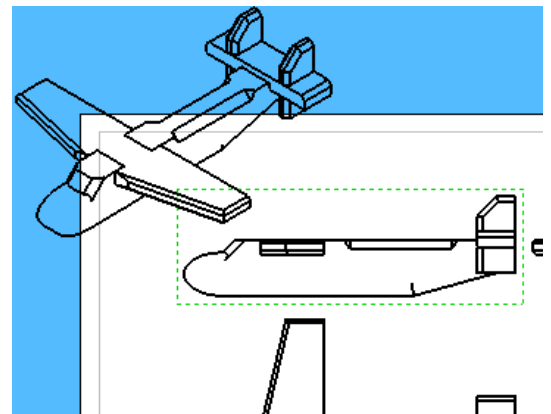
Ensure that start projected view is ticked so that further views are projected once the first one is positioned.

Positioning the Views

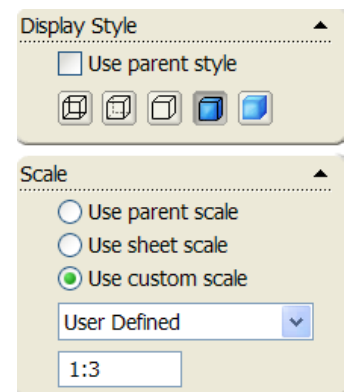
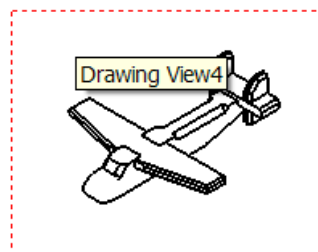
Position the front view on the sheet.
Drag the cursor to the right to project an end view.
Drag down to project a plan.

Project an isometric view by dragging the cursor to the top corner of the front view shown.

To position this isometric view in the required location hold down the **ctrl** key while dragging.



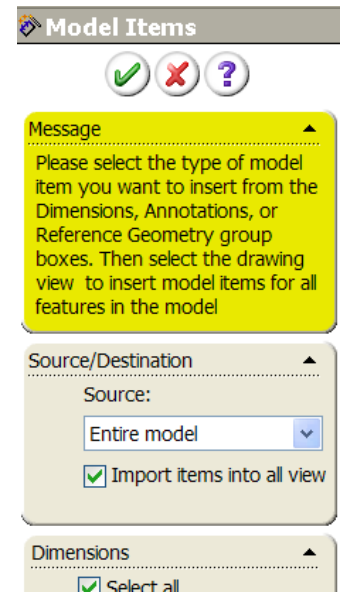
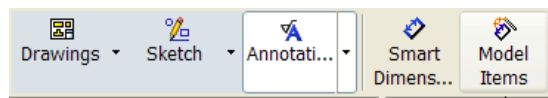
Change the scale of this view by selecting the box shown and changing the scale to **1:3**



Change its display style to **Shaded with Edges**.

Inserting Dimensions

Select **Model items** from the **Annotations** toolbar.



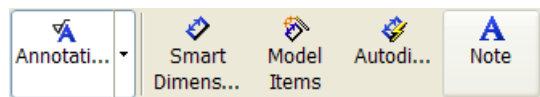
Choose the **entire model** as the source.

Tick **select all** dimensions.

Select **ok** to accept.

Delete some of the dimensions that are not needed.

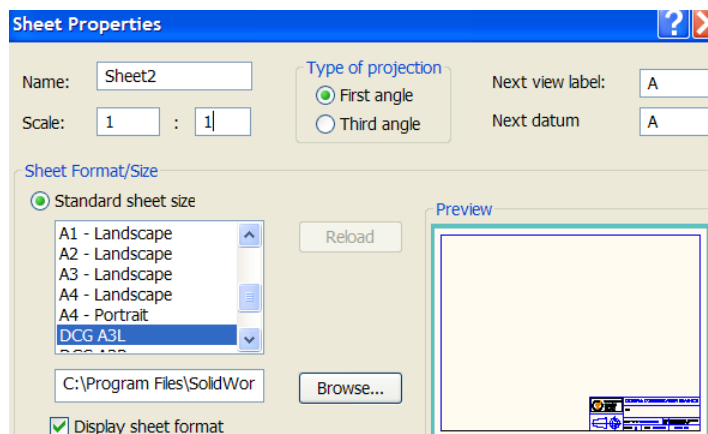
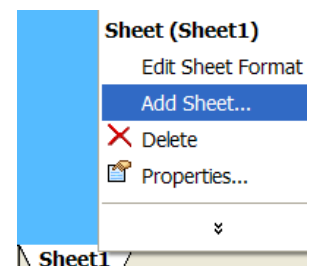
In the **Annotation** toolbar select **Note** and name the views.



Drawing Exploded View

Adding Sheet2

Right click on **Sheet 1** tab (located at bottom left of graphics area) and select **Add Sheet**

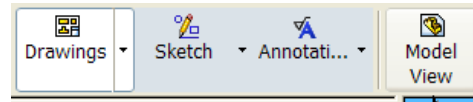


Change the scale to **1:1**.

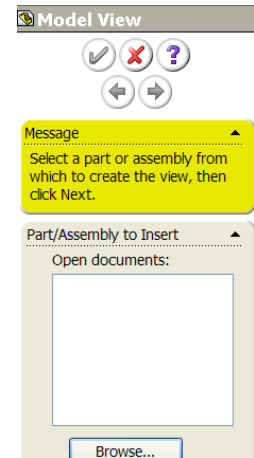
Accept.

Sheet2 now becomes the current sheet

Select the **Drawings** toolbar and **Model views**

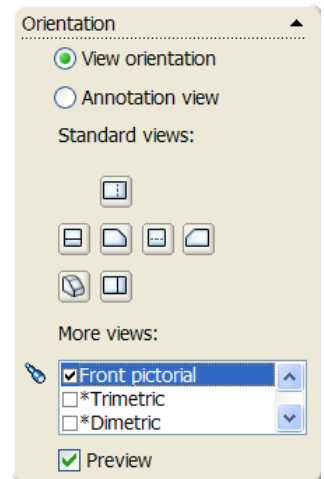


IN the **Model view** command manager select browse and open “**Aeroplane Assembly**”.



The front view is selected by default.

To select the desired view tick “**Front Pictorial**” as shown.

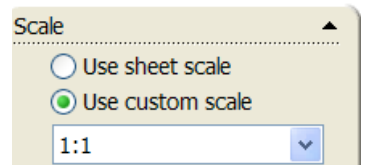


Tick the preview box also.

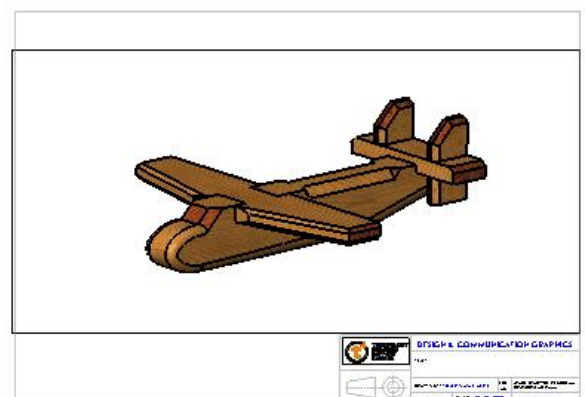
Scroll down the property manager and change the display to shaded with edges.



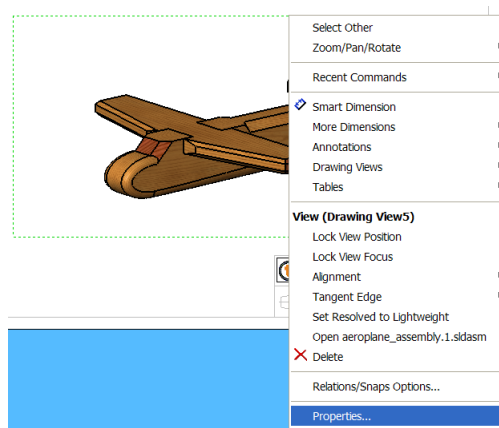
Change the scale to **1:1**



Place the drawing on the sheet.



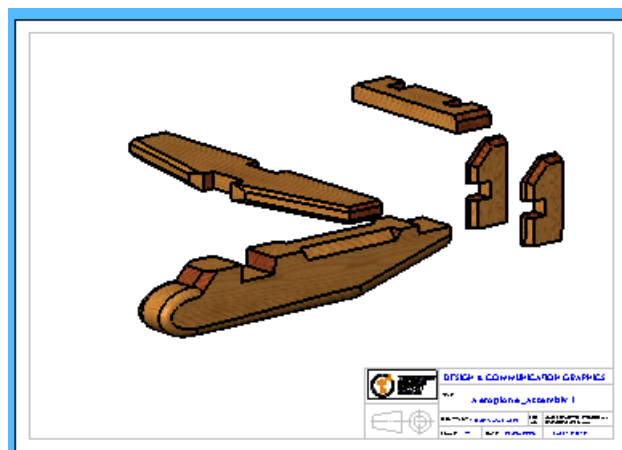
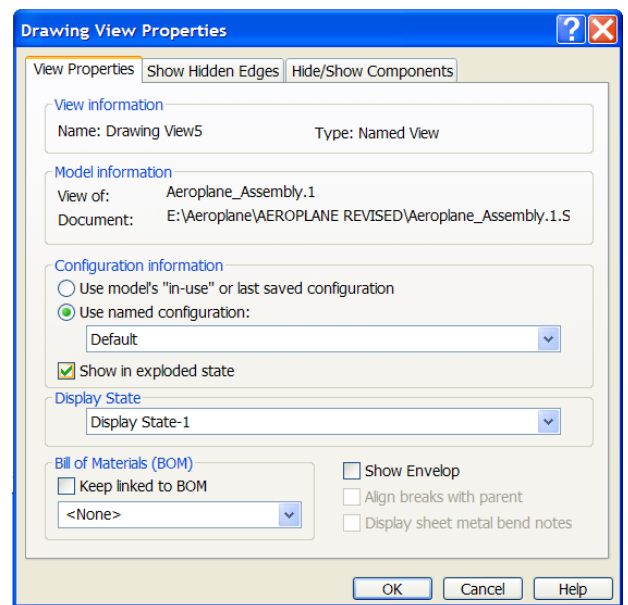
To show the Exploded view right click on the box and select properties as shown.



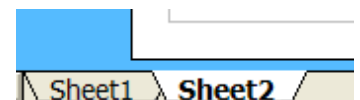
In the Properties dialog box tick the “show in exploded state box”.

Select ok.

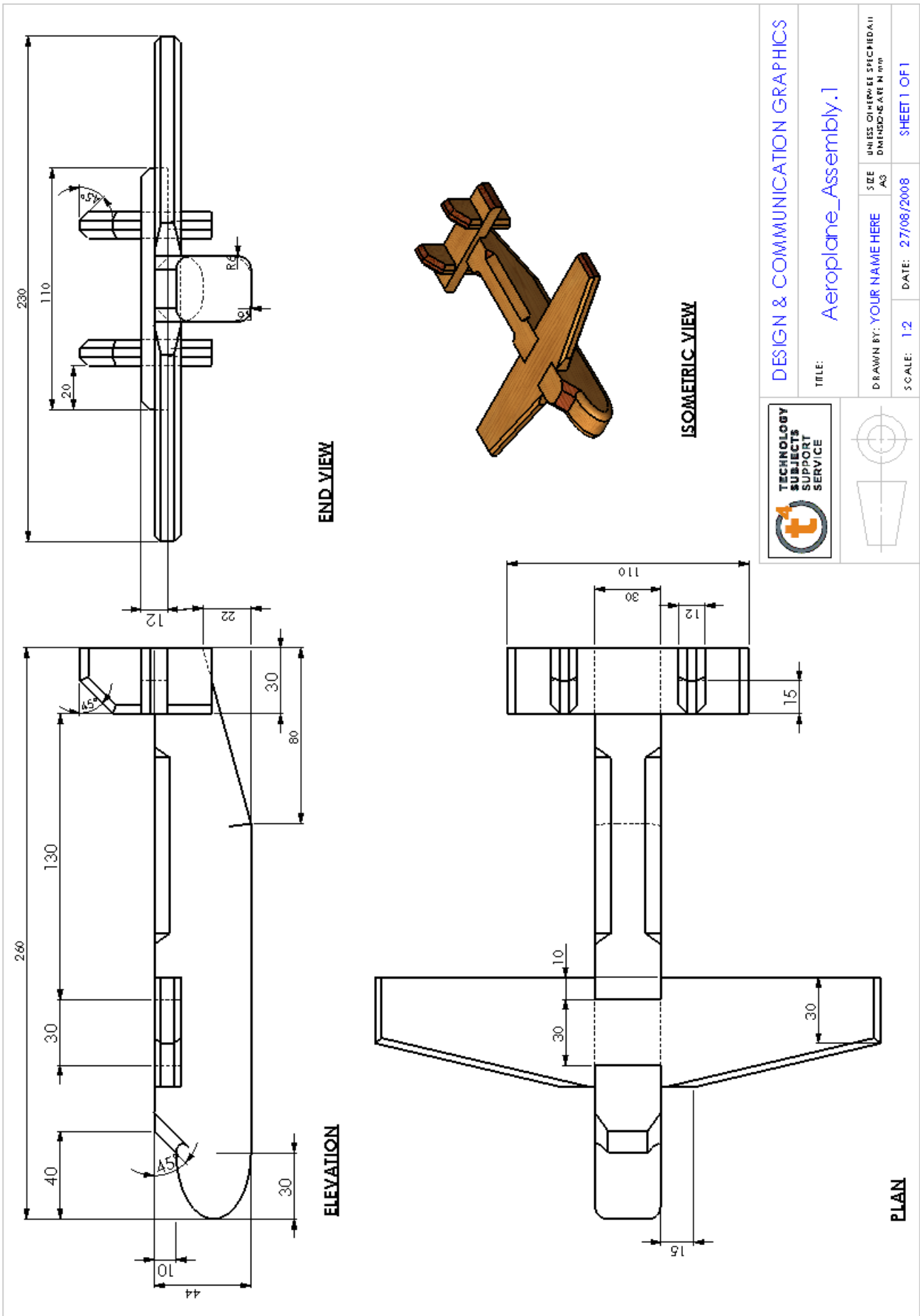
Save .

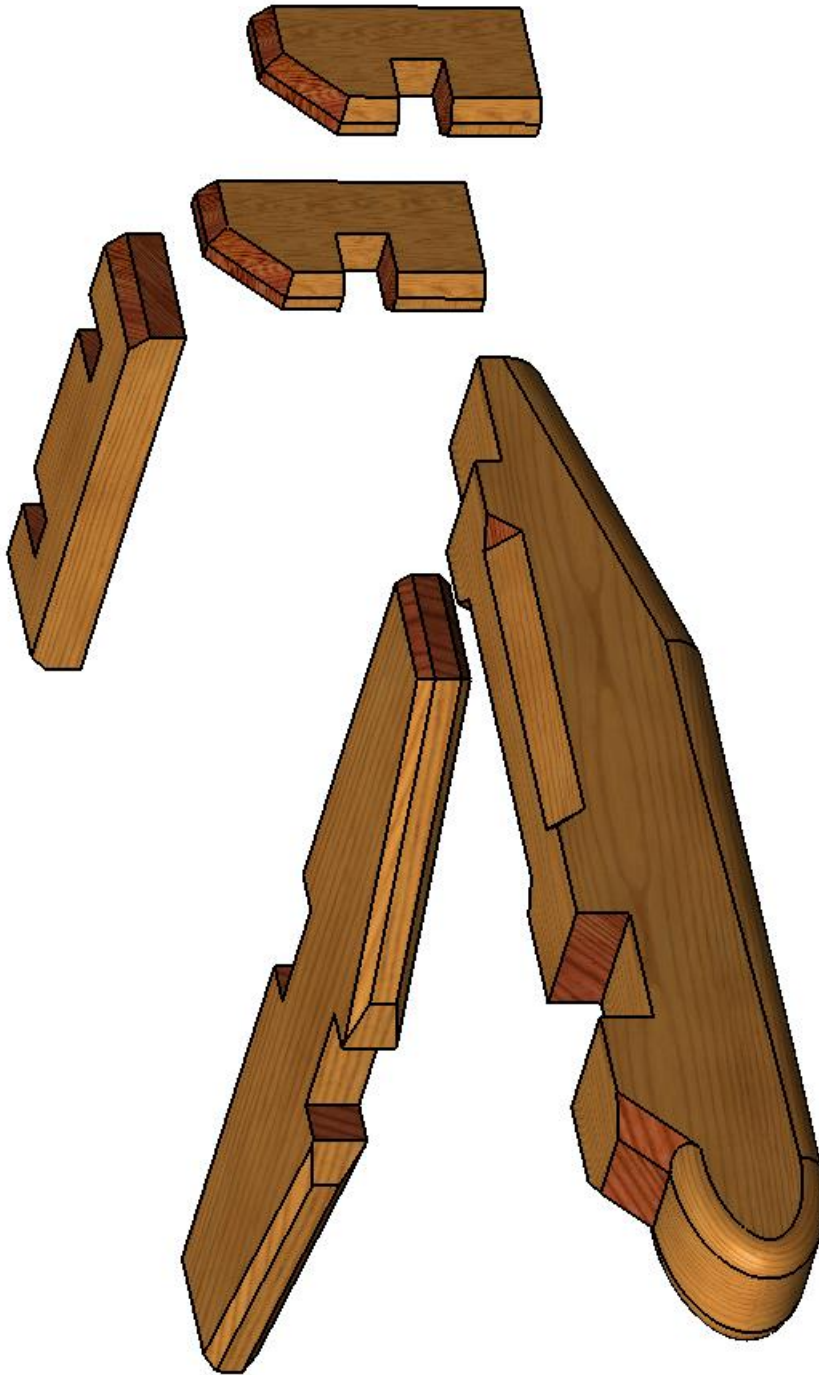


To switch between sheet 1 and sheet 2 just select sheet1 or sheet2 at the bottom of the drawing area.



Exercise Complete!





	DESIGN & COMMUNICATION GRAPHICS		
	TITLE: Aeroplane_Assembly.1		
	DRAWN BY: YOUR NAME HERE	SIZE: A3	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN mm
	SCALE: 1:1	DATE: 27/08/2008	SHEET 2 OF 2

