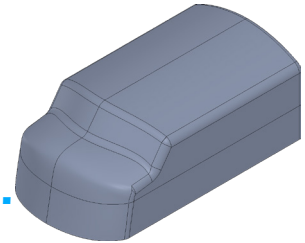




Chapter 16

Solar Train

Loco Master Model



A. Surface Extrude1 Sketch1 Reference Surfaces.

Step 1. Click **New**  on the Standard toolbar, click **Part Metric**  and OK.

Step 2. Click **Right Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 1**.

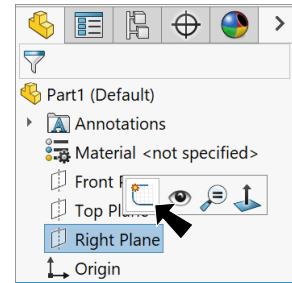


Fig. 1

Step 3. Click **Corner Rectangle**  in the **Rectangle flyout**  on the Sketch toolbar.

Step 4. Sketch rectangle at **Origin** , **Fig. 2**.

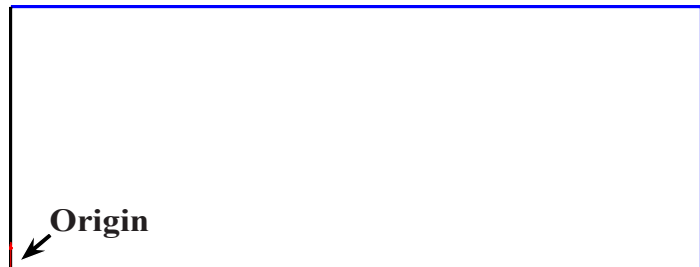


Fig. 2

Step 5. Click **Smart Dimension** (S) on the Sketch toolbar: 

Step 6. Add dimensions, **Fig. 3**.



Fig. 3

Step 7. If necessary, turn on **Surfaces** Command Manager. To turn on, **right click Sketch**  on the Command Manager toolbar select > **Tabs** > **Surfaces**, **Fig. 4**.

Step 8. Click **Surfaces**  on the Command Manager toolbar.

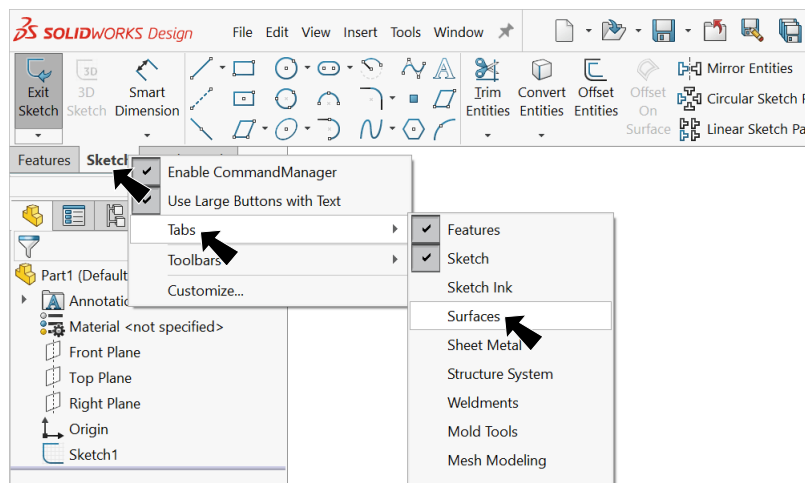
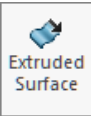


Fig. 4

Step 9. Click **Extruded Surface**  on the Surfaces toolbar.

Step 10. In the Surface-Extrude Property Manager set:

under Direction 1, **Fig. 5**

End Condition **Blind**

Depth  **26**

check **Cap end**

click OK .

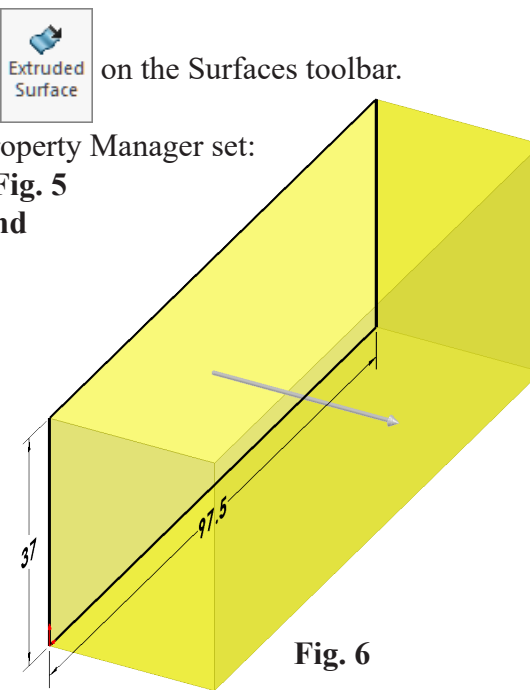


Fig. 6

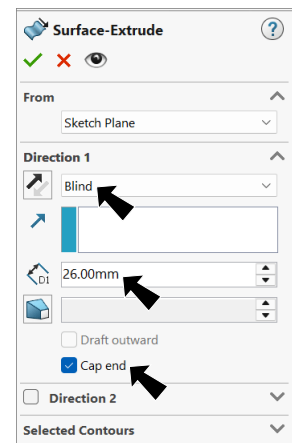


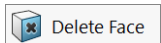
Fig. 5

B. Save as "MASTER MODEL".

Step 1. Click File Menu > Save As.

Step 2. Key-in **MASTER MODEL** for the filename and press ENTER.

C. Delete Face.

Step 1. Click **Delete Face**  on the Surfaces toolbar.

Step 2. In the Delete Face Property Manager:

under Selections, **Fig. 7**

click **2 faces: front and top, Fig. 8**

under Options

select **Delete**

click OK .

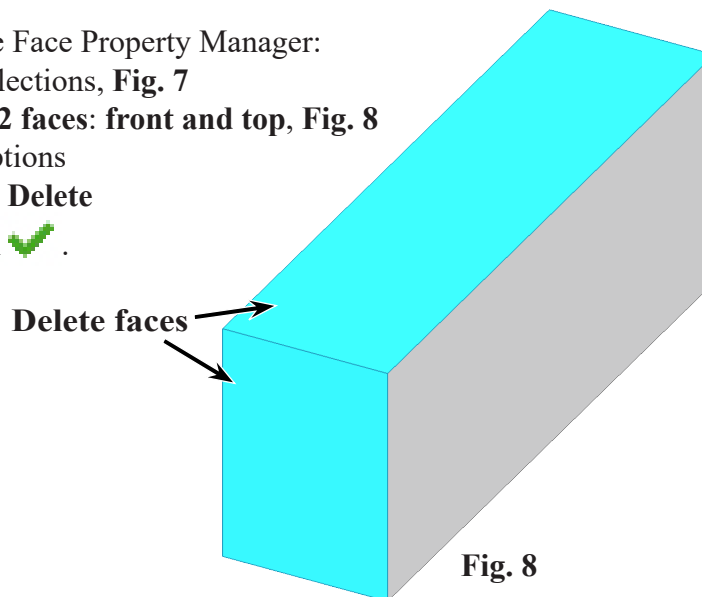


Fig. 8

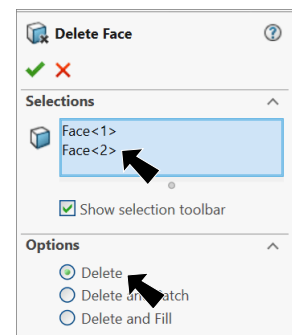


Fig. 7

D. Surface Extrude2 Sketch2 Tangent Surface Windshield.

Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 9**.

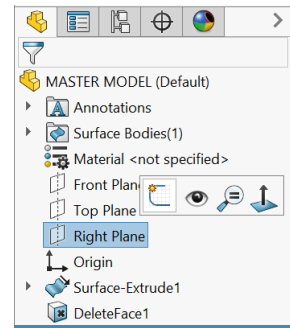


Fig. 9

Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Line**  (L) on the Sketch toolbar.

Step 4. Sketch **line at angle**, **Fig. 10**.

Step 5. Click **Smart Dimension**  (S) on the Sketch toolbar.

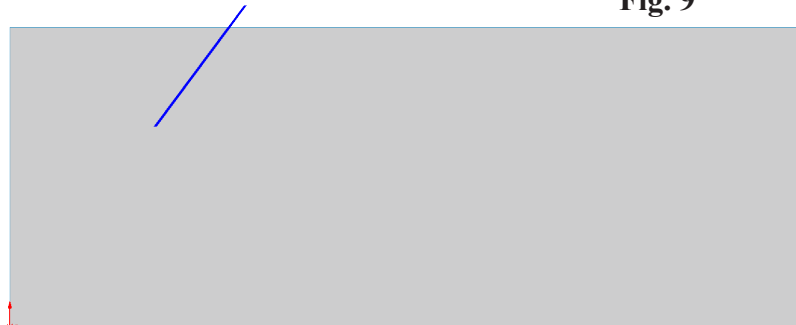


Fig. 10

Step 7. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 8. Click **Surfaces**  on the Command Manager toolbar.

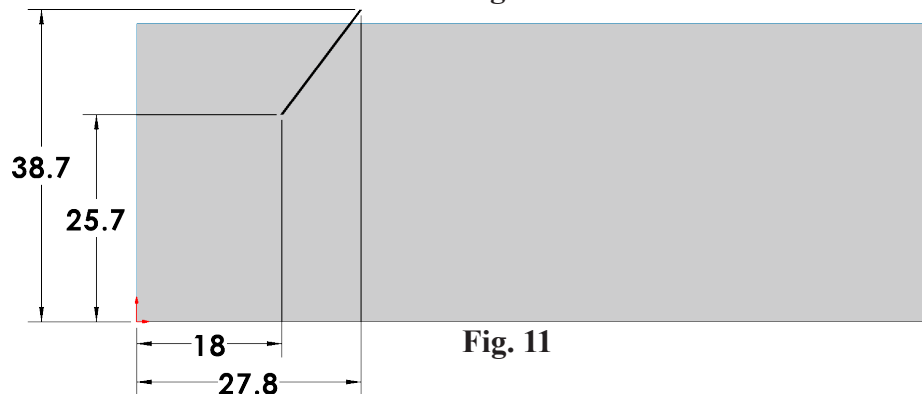
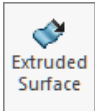


Fig. 11

Step 9. Click **Extruded Surface**  on the Surfaces toolbar.

Step 10. In the Surface-Extrude Property Manger:
under Direction 1, **Fig. 12**

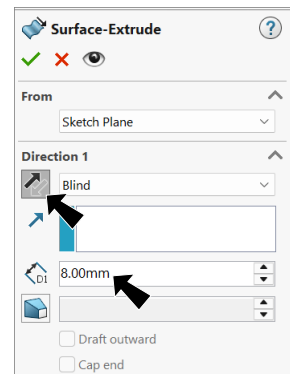


Fig. 12

Depth  8
Reverse Direction 
click OK .

Step 11. Save  (Ctrl-S).

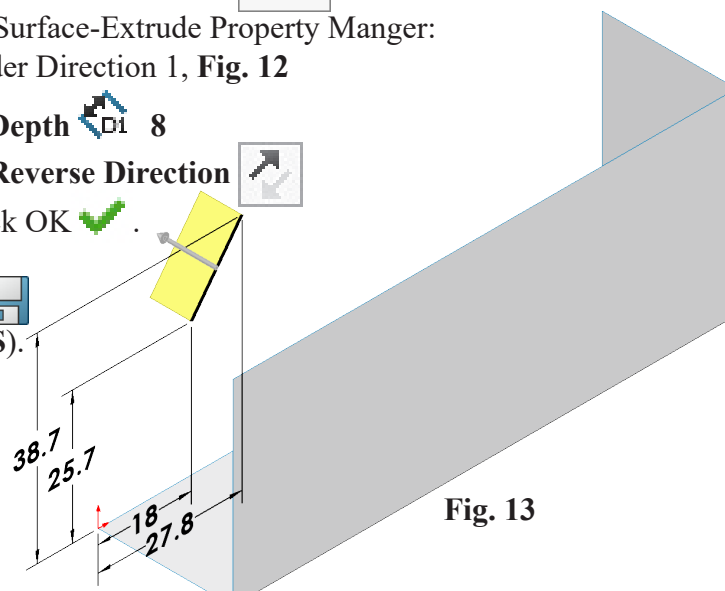


Fig. 13

E. Surface Loft1 Sketch3 Profile1 Windshield.

Step 1. Click the **side face** and click **Sketch**  on the context toolbar, **Fig. 14**.

Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Line**  (**L**) on the Sketch toolbar.

Step 4. Sketch **line at angle**, **Fig. 15**.

Step 5. Click **Smart Dimension**  (**S**) on the Sketch toolbar.

Step 6. Add dimensions, **Fig. 16**.

Step 7. Click **Exit Sketch**  on the Sketch toolbar.

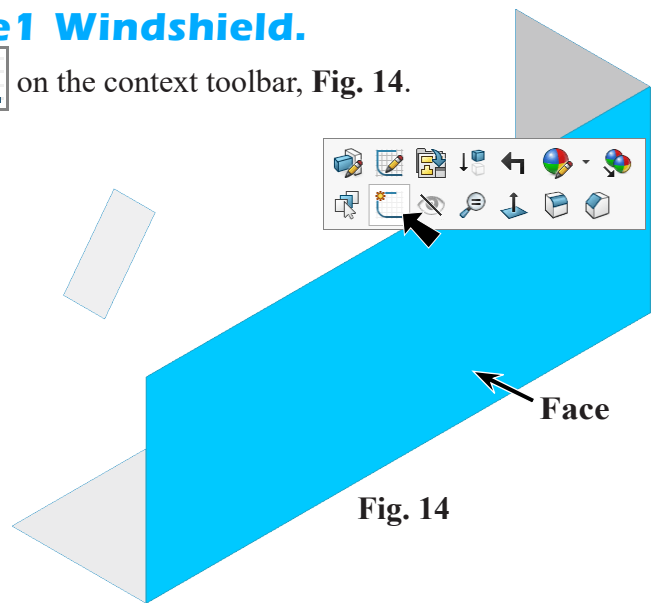


Fig. 14

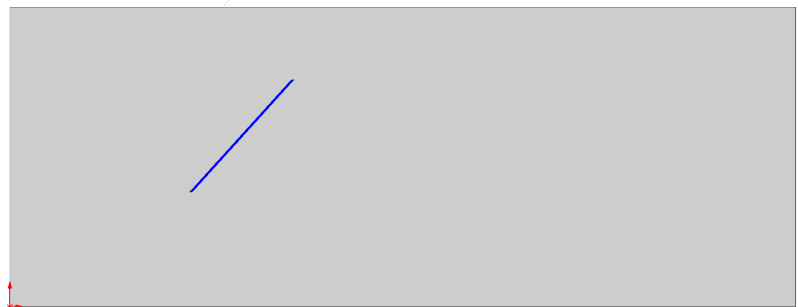


Fig. 15

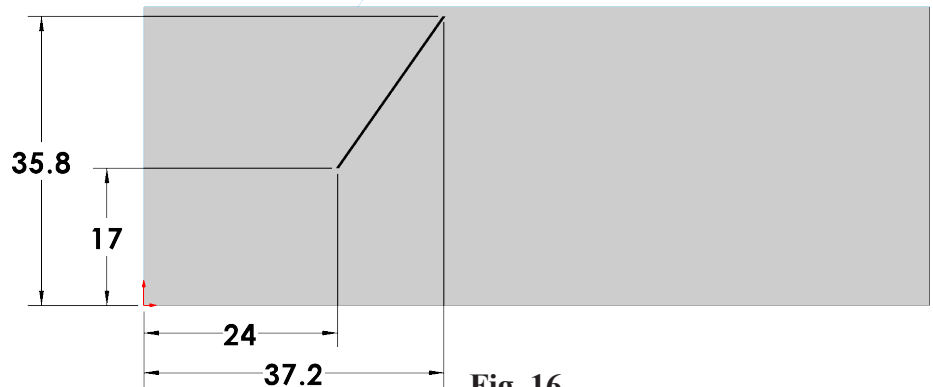
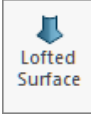


Fig. 16

F. Loft Surface 1 Windshield.

Step 1. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 2. Click **Surfaces**  on the Command Manager toolbar.

Step 3. Click **Lofted Surface**  on the Surfaces toolbar.

Step 4. In the Surface-Loft Property Manager set:

under Profiles, **Fig. 17**

click **Sketch3** and **edge of Surface Extrude1** in order at the same location to keep the connectors aligned, **Fig. 18**

With the edge selected (highlighted)

Expand Start/End Constraints

End Tangency Type **Tangent To Face**

click OK .

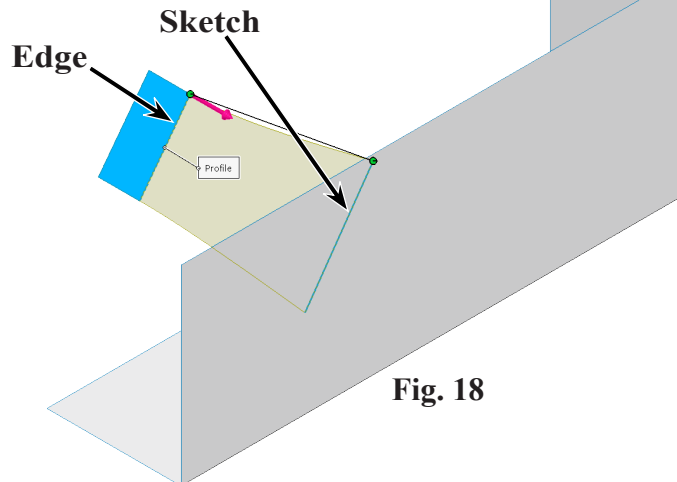


Fig. 18

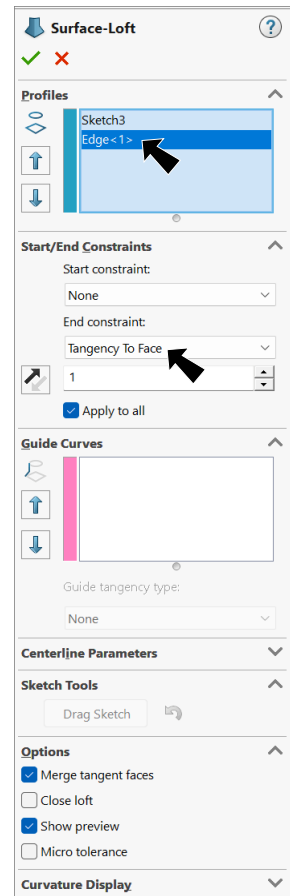


Fig. 17

Step 5. **Hide Surface-Extrude2** . To hide, click **Surface** in graphics area and **Hide**  on the context toolbar, **Fig. 19**.

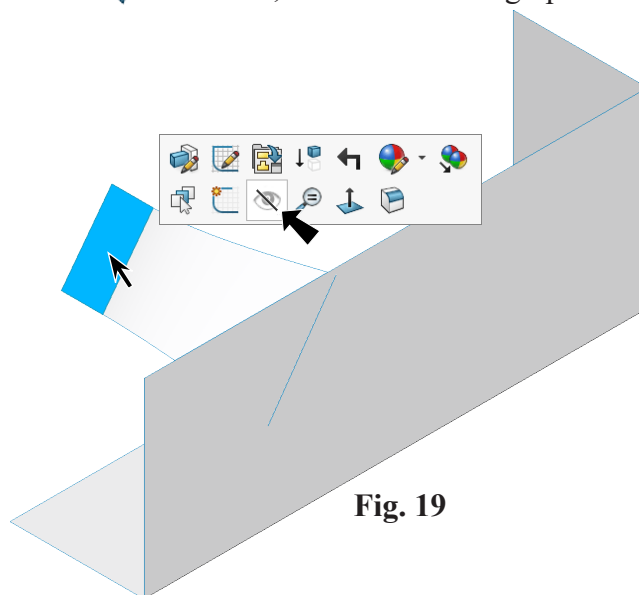


Fig. 19

G. Surface Loft2 Sketch4 Profile1 Hood.

Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**



on the context toolbar, **Fig. 20**.

Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Style Spline**  in the **Spline flyout**  on the Sketch toolbar.

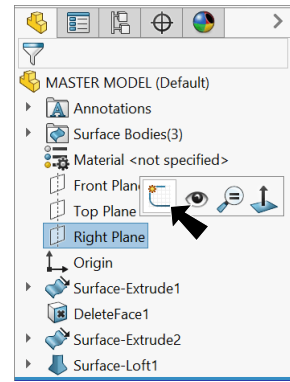


Fig. 20

Step 4. Starting at Origin  sketch a **4 control vertex point Spline**, **Fig. 21**. Press Escape to end spline.

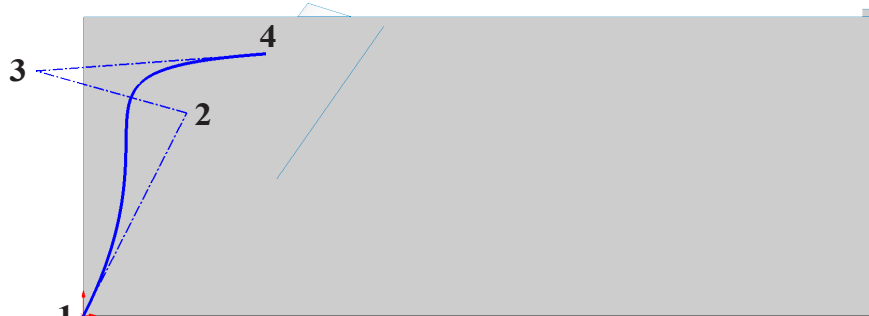


Fig. 21

Step 5. **Ctrl click 3rd Spline control vertex point and left edge** to select both. Release Ctrl key and click **Make Coincident**  on the context toolbar, **Fig. 22**.

Ctrl click control point and edge

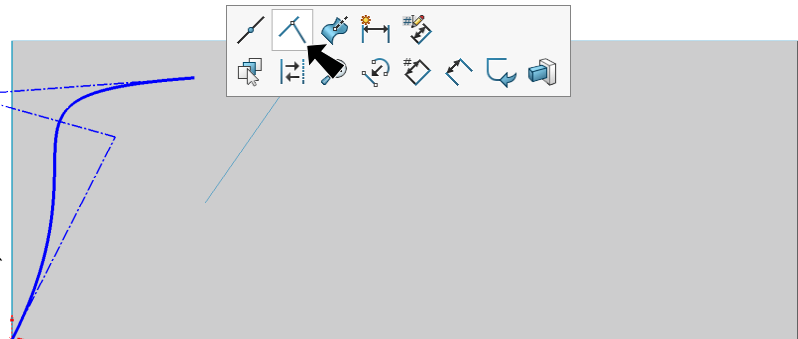


Fig. 22

Step 6. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 7. Add dimensions, **Fig. 23**.

Step 8. Click **Exit Sketch**  on the Sketch toolbar.

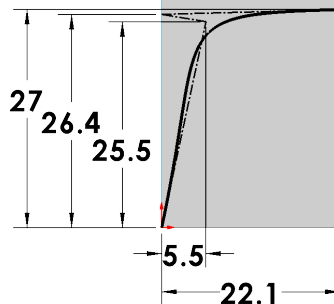
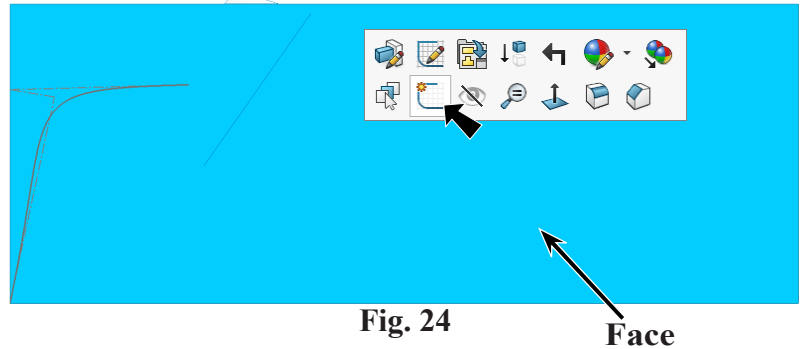


Fig. 23

H. Surface Loft2 Sketch5 Profile2 Hood.

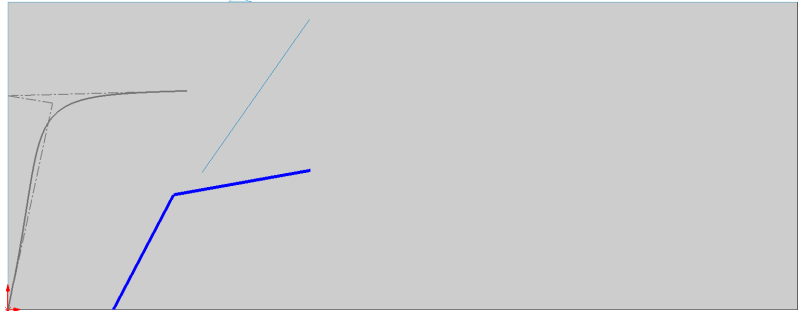
Step 1. Click the **side face** and click

Sketch  on the context toolbar, **Fig. 24**.



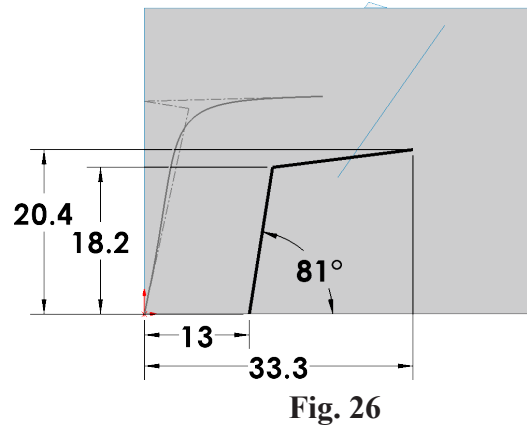
Step 2. Click **Line**  (L) on the Sketch toolbar.

Step 3. Starting from bottom edge sketch 2 chained angled lines, **Fig. 25**.



Step 4. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 5. Add dimensions, **Fig. 26**.



Step 6. Click **Sketch Fillet**  on the Sketch toolbar.

Step 7. In the Sketch Fillet Property Manager set:
under Fillet Parameters, **Fig. 27**

Radius  **4.3**
click intersection of lines, **Fig. 28**
click OK  twice.

Step 8. Click **Exit Sketch**  on the Sketch toolbar.

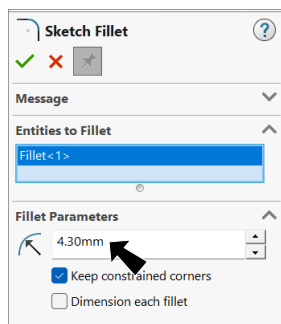


Fig. 27

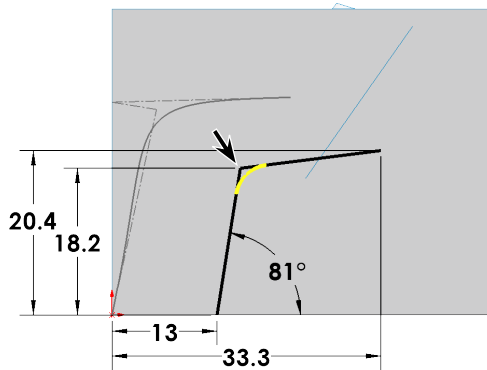


Fig. 28

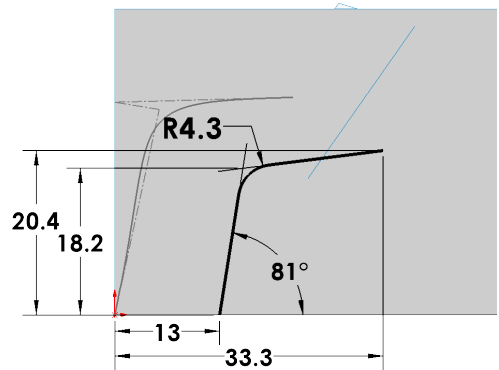


Fig. 29

I. Surface Loft2 Sketch6 Guide Curve Hood.

Step 1. Click **Top Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 30**.

Step 2. Click **Normal To** on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Zoom in on front, **Fig. 31**.

Step 4. Click **Style Spline** in the **Spline** flyout on the Sketch toolbar.

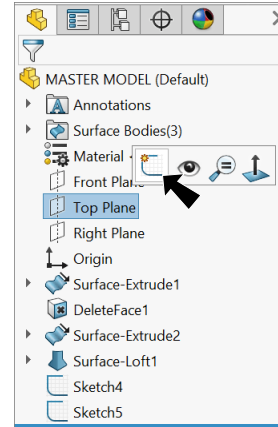


Fig. 30

Step 5. Starting at Origin sketch a **4 control vertex point Spline**, **Fig. 32**. Press Escape to end spline.

Step 6. **Ctrl click right control vertex point of Spline and Sketch5** to select both. Release Ctrl key

and click **Make Pierce** on the context toolbar, **Fig. 33**. Make Pierce adds a Pierce relation between sketches.

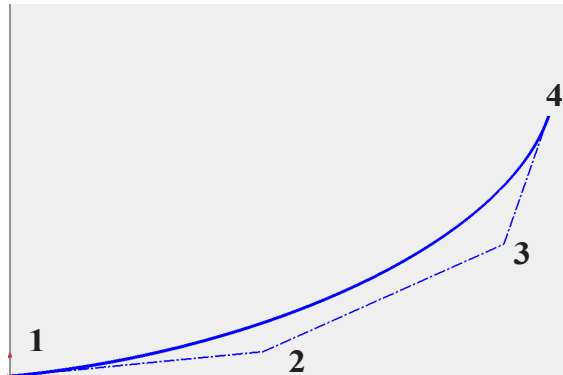
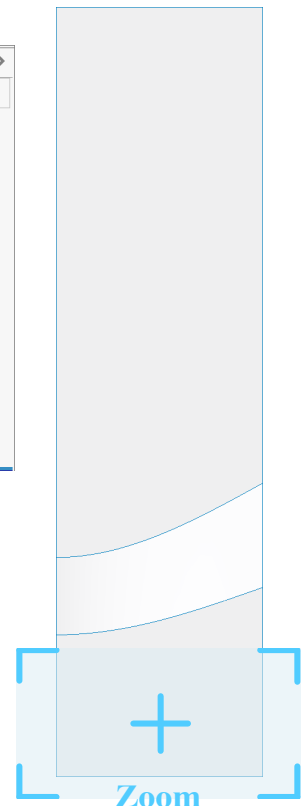


Fig. 32



Zoom
Fig. 31

Step 7. Click **Smart Dimension** (S) on the Sketch toolbar.

Step 8. Add dimensions, **Fig. 34**.

Step 9. Click **Exit Sketch** on the Sketch toolbar.

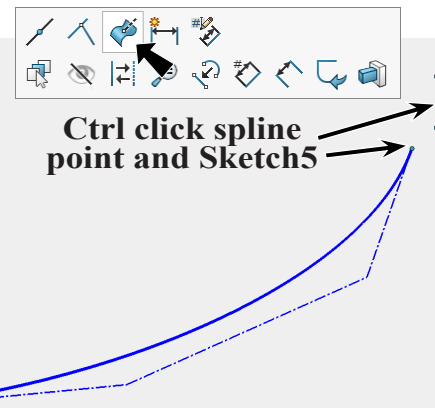


Fig. 33

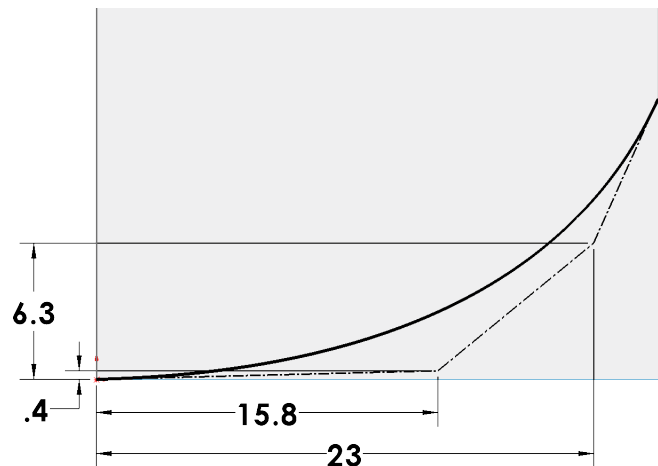
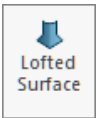


Fig. 34

J. Loft Surface2 Hood.

Step 1. Click **Isometric**  on the Standard Views toolbar. (Ctrl-7)

Step 2. Click **Surfaces**  on the Command Manager toolbar.

Step 3. Click **Lofted Surface**  on the Surfaces toolbar.

Step 4. In the Surface-Loft Property Manager set:
 under Profiles, **Fig. 35**
 click **each profile** in order at the same location on sketch to
 keep the connectors aligned, **Fig. 36**
 under Guide Curves
 click in box then
 click **guide curve Sketch6**
 under Profiles
 click **Sketch4** to select
 under Start/End Constraints
 Start Tangency Type **Normal to Profile**
Reverse Direction 
Start Tangency Length 8
 click OK .

Step 5. Save  (Ctrl-S).

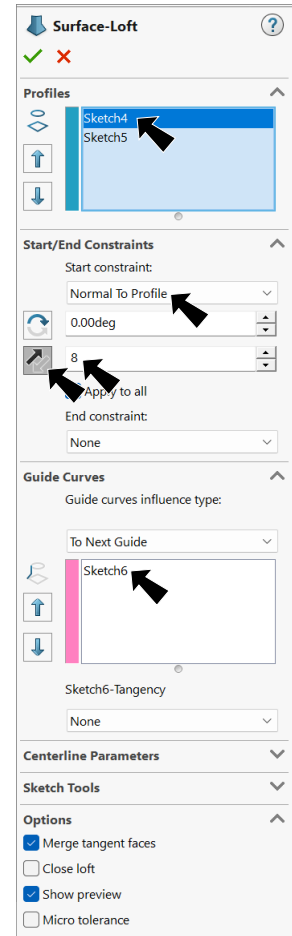
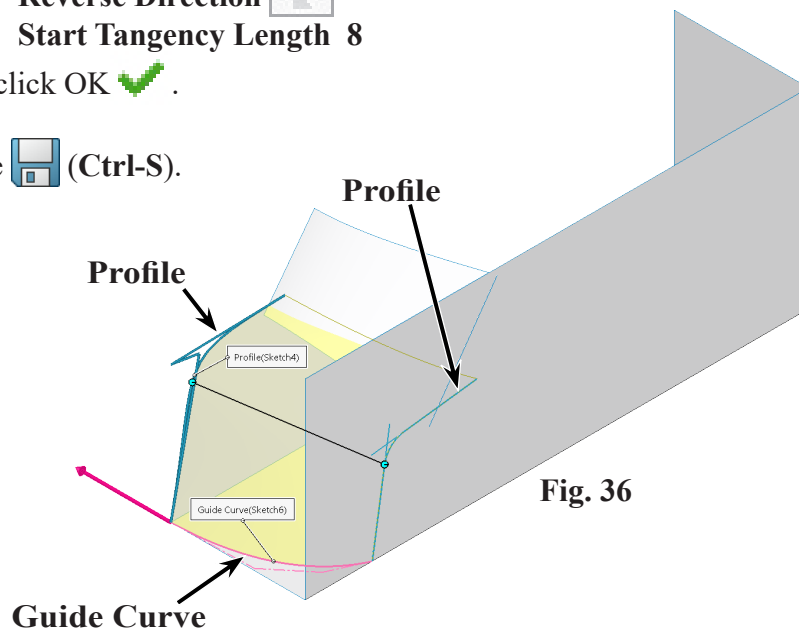


Fig. 35

K. Surface Extrude3 Sketch7 Roof.

Step 1. Click **Front Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 37**.

Step 2. Click **Normal To**  on the Standard Views toolbar.

Step 3. Click **3 Point Arc**  (S) in the **Arc** flyout  on the Sketch toolbar.

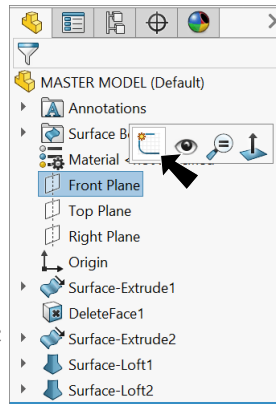


Fig. 37

Step 4. Sketch arc between side edges and radius up, **Fig. 38**.

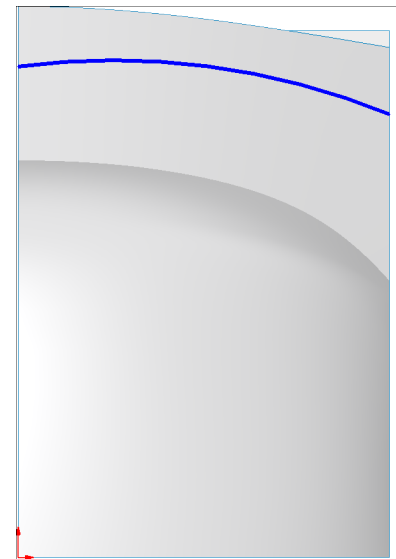


Fig. 38

Step 5. **Unselect Arc tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 6. **Ctrl click left endpoint of arc and top edge of Surface Extrude1** to select both. Release Ctrl key and

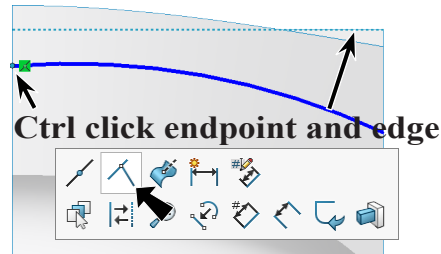


Fig. 39

click **Make Coincident**  on the context toolbar, **Fig. 39**.

Step 7. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 8. Add dimensions, **Fig. 40**.

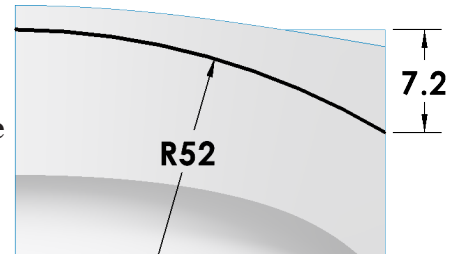
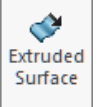


Fig. 40

Step 9. Click **Isometric**  on the Standard Views toolbar. (Ctrl-7)

Step 10. Click **Surfaces**  on the Command Manager toolbar.

Step 11. Click **Extruded Surface**  on the Surfaces toolbar.

Step 12. In the Surface-Extrude Property Manger: under Direction 1, **Fig. 41**

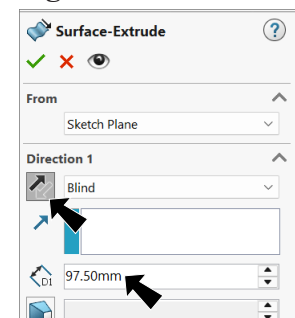


Fig. 41

Depth  97.5

Reverse Direction 

click OK .

Step 13. Save  (Ctrl-S).

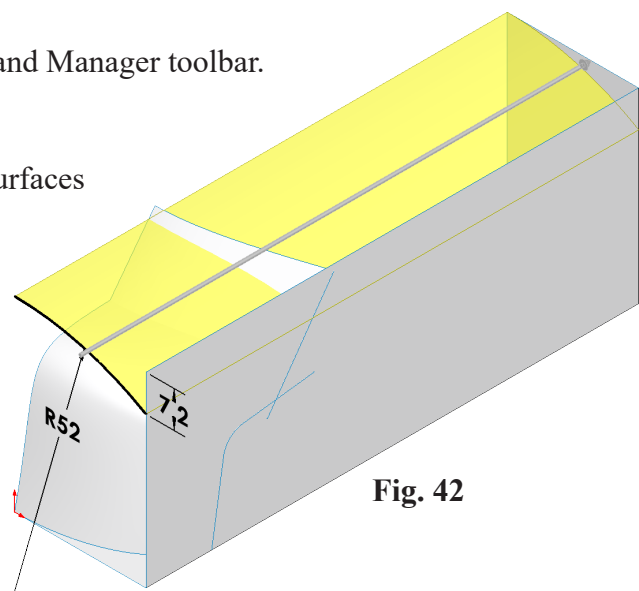
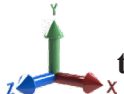
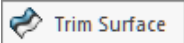


Fig. 42

L. Trim Surface 1.

Step 1. Rotate view to inside back side, **Fig. 44**. To rotate view, **Shift click the Y axis**  of the

Reference Triad  **twice.**

Step 2. Click **Trim Surface**  on the Surfaces toolbar.

Step 3. In the Trim Surface Property Manager set:

under Trim Type, **Fig. 43**

select **Mutual**

under Selections

Trimming Surfaces 

click **roof, windshield and hood surfaces**, **Fig. 44**
under Preview options

select **Show both included and excluded surfaces** 

select **Remove selections**

click in Pieces to Remove  box

click, **Fig. 45**

forward section of roof

top section of windshield

bottom section of windshield

rear section of hood

click OK .

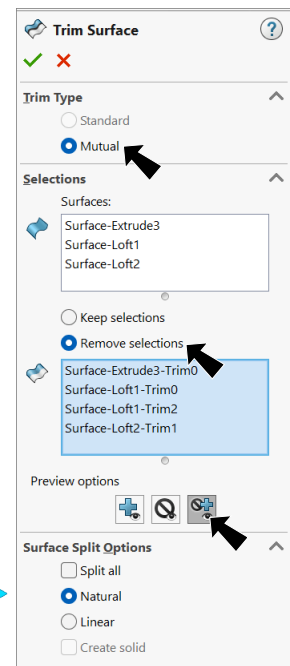


Fig. 43

Step 4. Save 
(Ctrl-S).

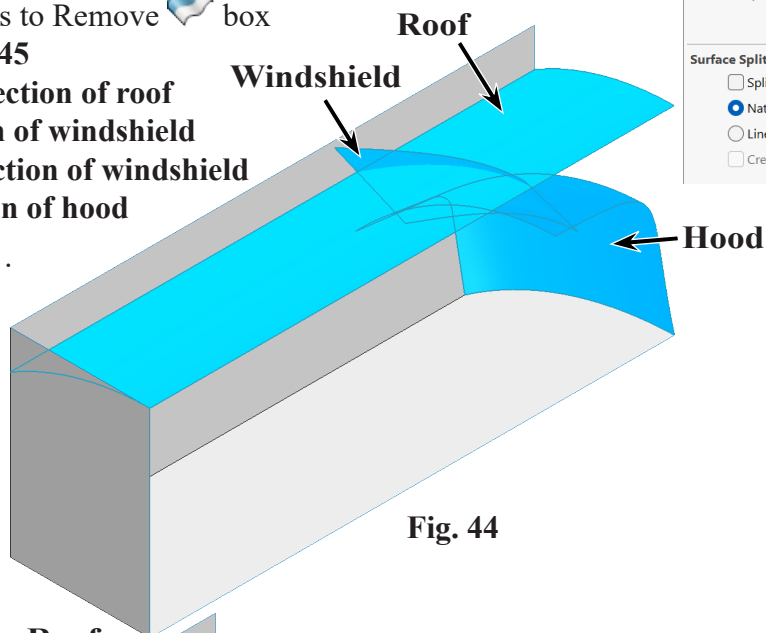


Fig. 44

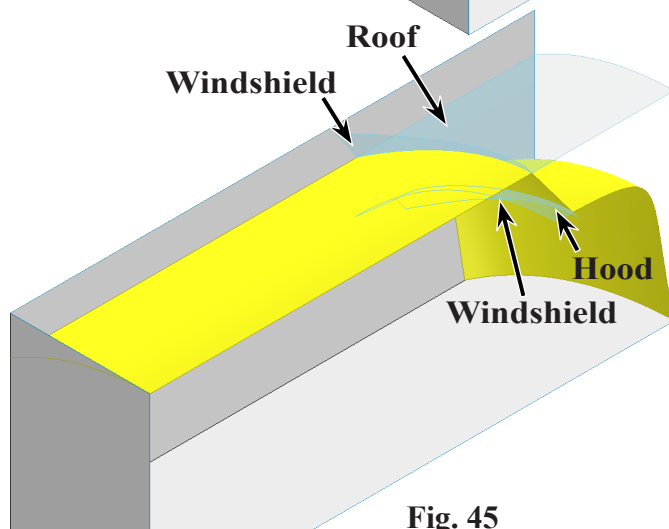


Fig. 45

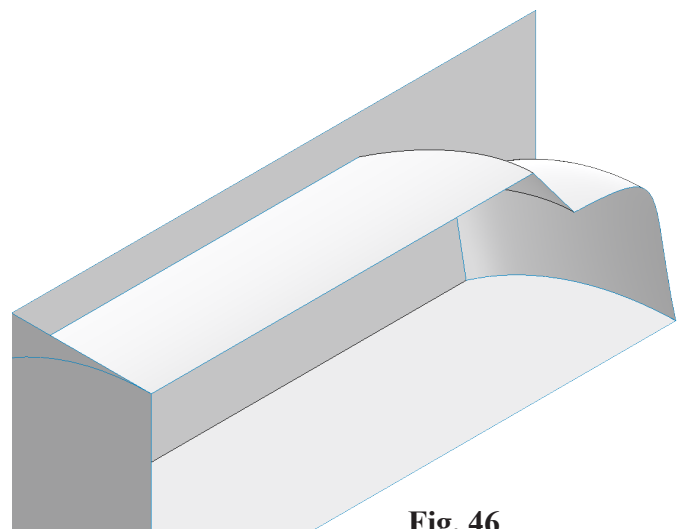
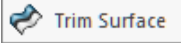


Fig. 46

M. Trim Surface2.

Step 1. Click **Trim Surface**  on the Surfaces toolbar.

Step 2. In the Trim Surface Property Manager set:

under Trim Type, **Fig. 47**

select **Mutual**

under Selections

Trimming Surfaces 

click **driver's side surface and roof surface, Fig. 48**

select **Remove selections**

in Pieces to Remove  box

click **top section of driver's side surface, Fig. 49**

click OK .

Step 3. Save  (Ctrl-S).

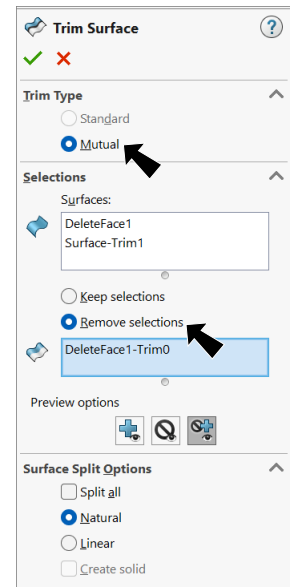


Fig. 47

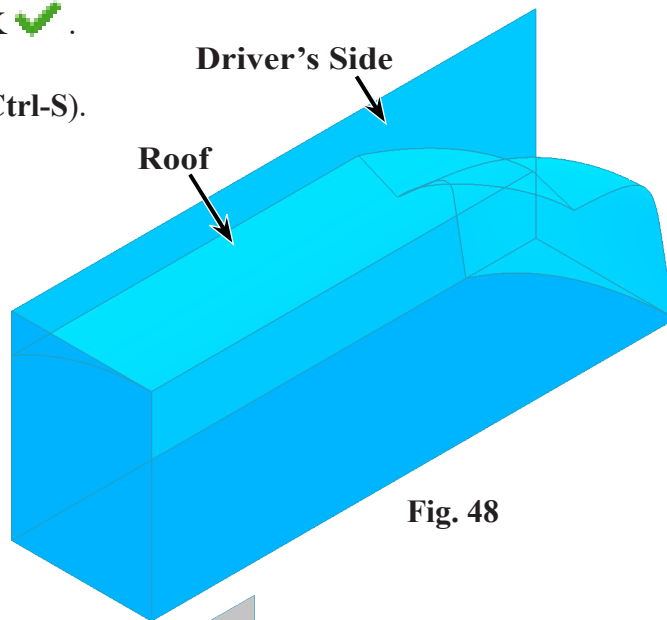


Fig. 48

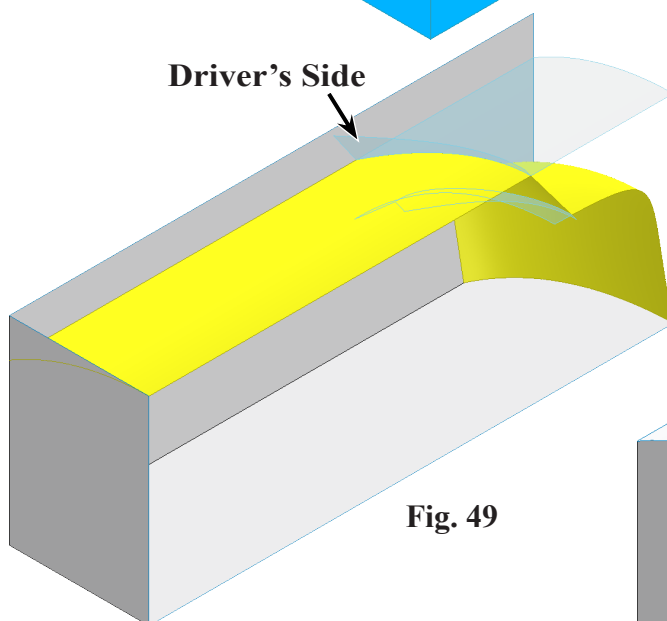


Fig. 49

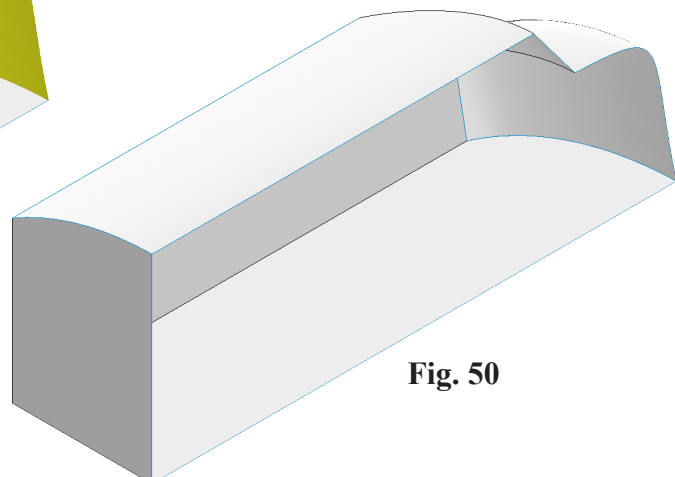


Fig. 50

N. Surface Fill 1.

Step 1. Click **Surfaces**  on the Command Manager toolbar.

Step 2. Click **Filled Surface**  on the Surfaces toolbar.

Step 3. In the Fill Surface Property Manger set:

under Patch Boundary, **Fig. 51**

click **each edge (5)**, **Fig. 52**

check **Optimize surface**

check **Show preview**

under Options

check **Fix up boundary**

check **Merge result**

check **Create solid**

click OK .

Step 4. Save  (Ctrl-S).

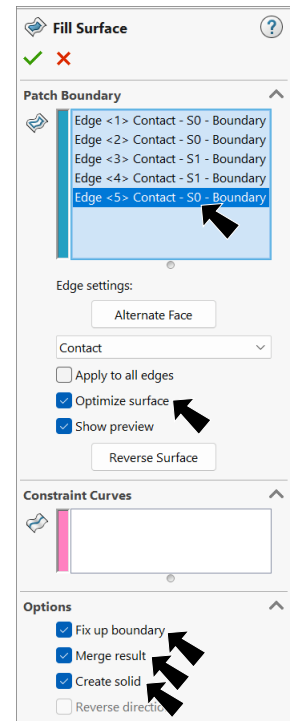


Fig. 51

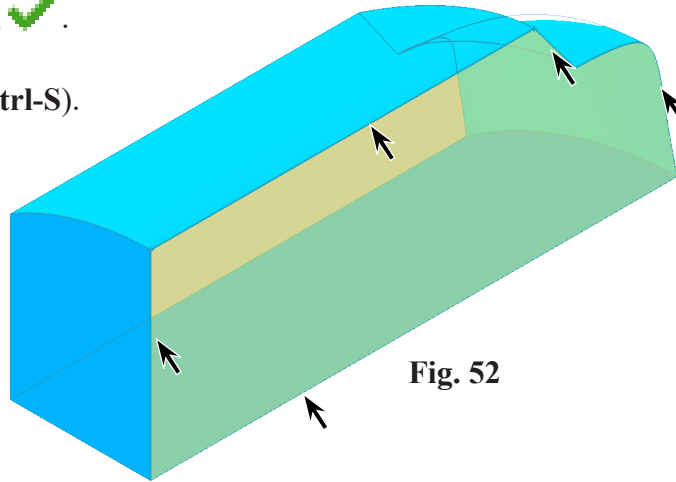


Fig. 52

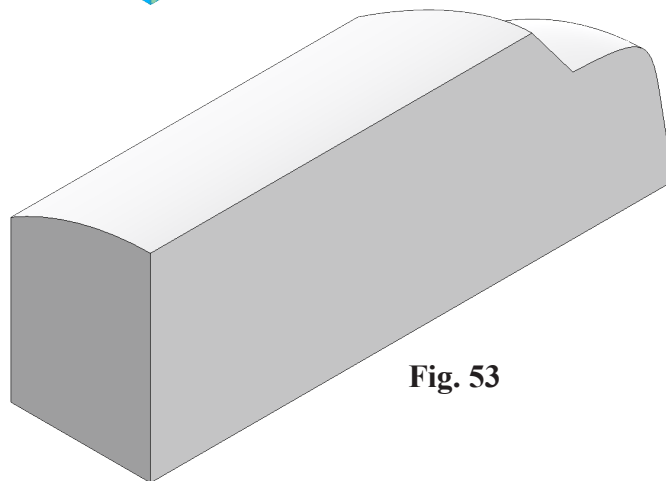


Fig. 53

O. Fillets 1-3.

Step 1. Click **Isometric**  on the Standard Views toolbar. (Ctrl-7)

Step 2. Click **Features**  on the Command Manager toolbar.

Step 3. Click **Fillet**  on the Features toolbar.

Step 4. In the Fillet Property Manager set:
select **FilletXpert**, Fig. 54

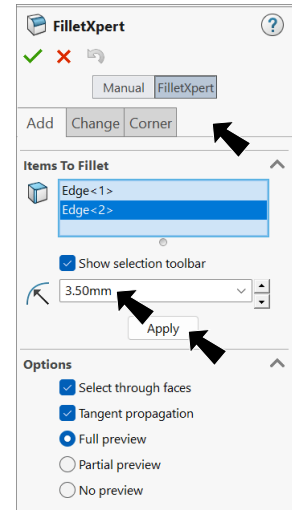


Fig. 54

① Radius  3.5
click top and bottom edge
of windshield (2),
Fig. 55
click Apply

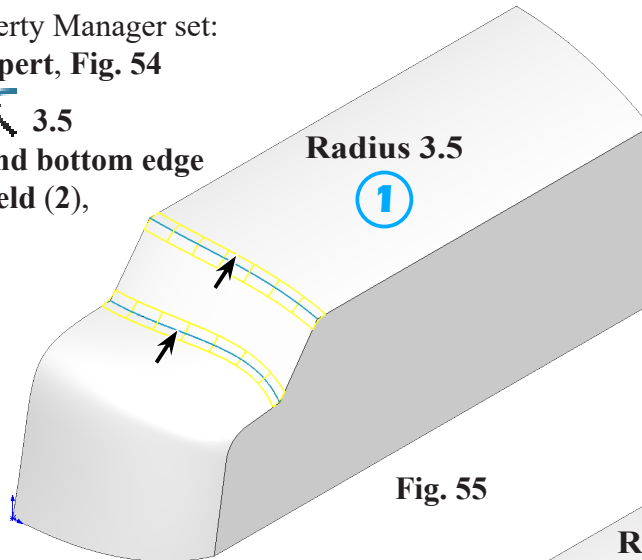


Fig. 55

② Radius  4
click edge along top outside of
part (1), Fig. 56
click Apply

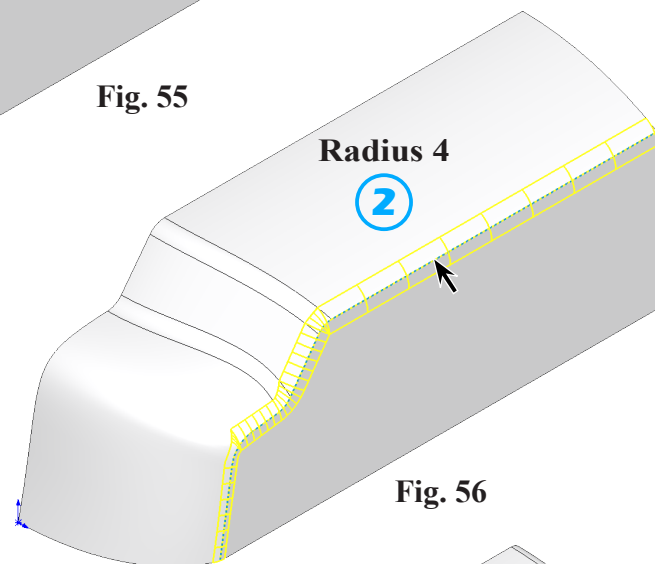


Fig. 56

③ Radius  2
click edge along rear (1), Fig. 57
click OK .

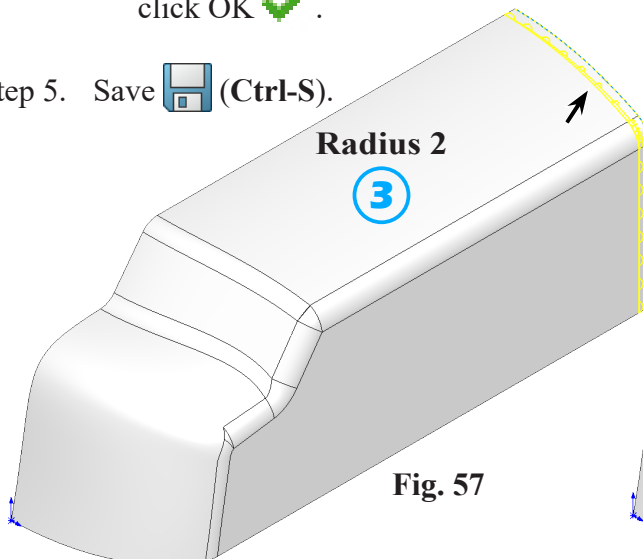


Fig. 57

Step 5. Save  (Ctrl-S).

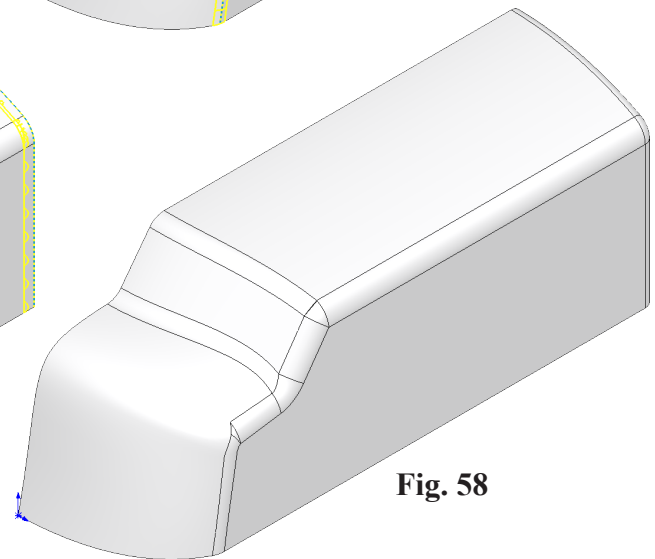


Fig. 58

P. Mirror Body.

Step 1. Expand Solid Bodies folder in the Feature Manager. **Ctrl click Fillet3 body and Right Plane** to select body and plane, Fig. 59.

Step 2. Click **Mirror** on the Features toolbar.

Step 3. In the Mirror Property Manager click OK .

Step 4. Save  (Ctrl-S).

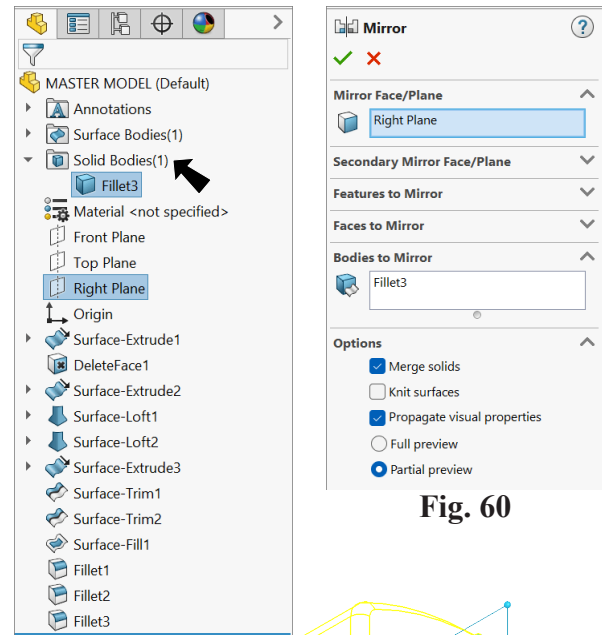


Fig. 59

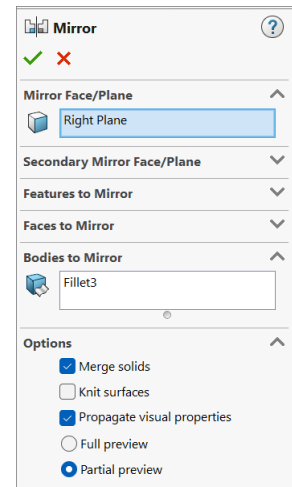


Fig. 60

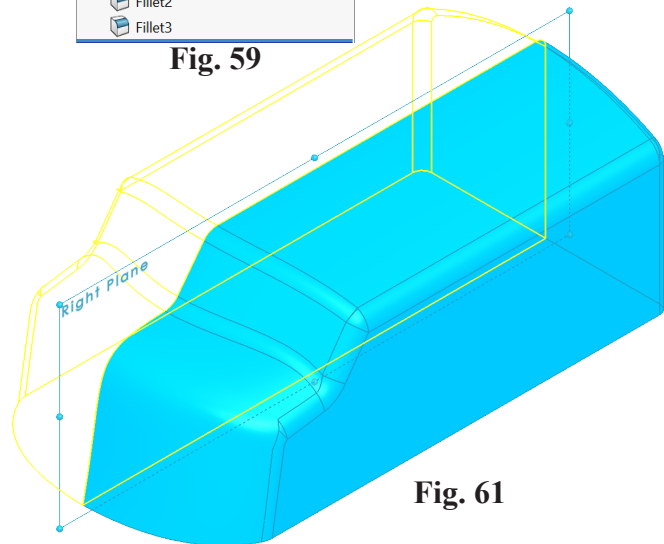


Fig. 61

Q. Shell.

Step 1. Click **Shell** on the Features toolbar.

Step 2. In the Shell Property Manager set:
under Parameters, Fig. 62

Distance  1.5

check **Show preview**

click OK .

Step 3. Save  (Ctrl-S).

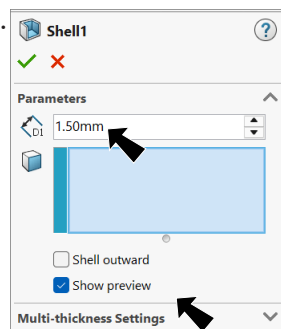


Fig. 62

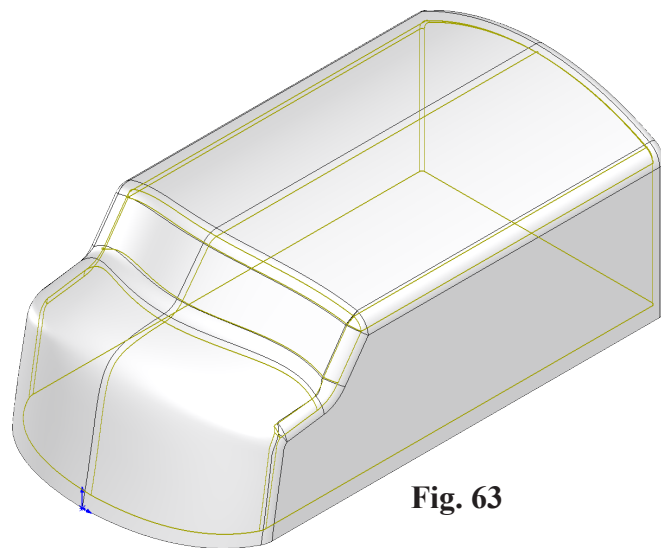


Fig. 63

R. Split.

Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 64**.

Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Line**  (**L**) on the Sketch toolbar.

Step 4. Sketch **horizontal line above Origin**  across all body, **Fig. 65**.

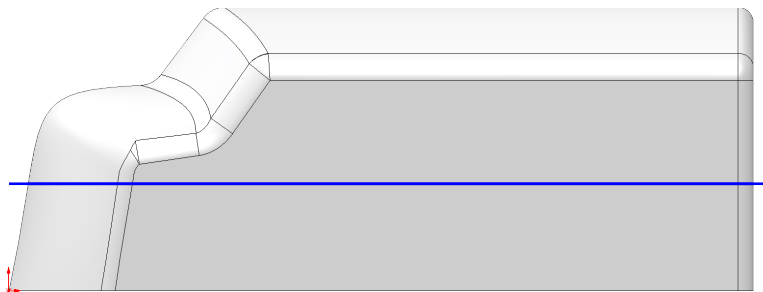


Fig. 65

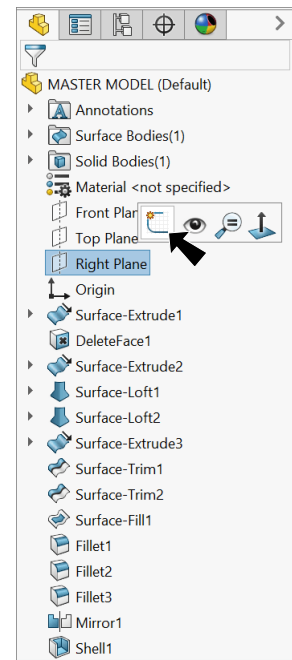
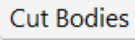


Fig. 64

Step 5. Click **Smart Dimension**  (**S**) on the Sketch toolbar.

Step 6. Add **14** dimension, **Fig. 66**.

Step 7. Click Insert Menu > Features > Split.

Step 8. In the Split Property Manager:
under Trim Tools, **Fig. 67**
Sketch8 was preselected
click **Cut Bodies**  button
under Resulting Bodies
click **Select All** 
uncheck **Consume cut bodies**
click OK .

Step 9. Save  (**Ctrl-S**).

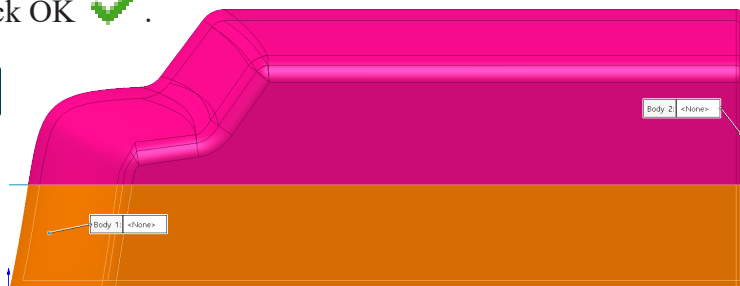


Fig. 68

Fig. 66

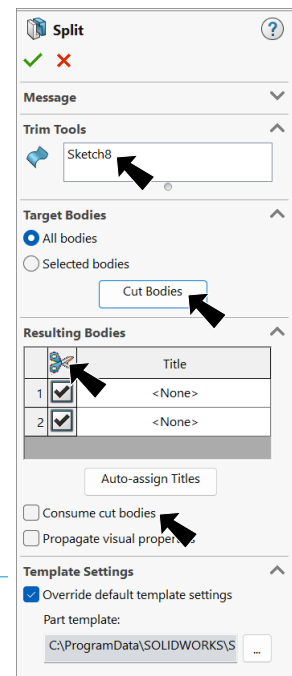


Fig. 67

S. Rename Bodies.

Step 1. **Hide Sketch8** . To hide, click **Sketch8**  in the Feature Manager and **Hide**  on the context toolbar, **Fig. 69**.

Step 2. **Rename bodies CHASSIS**  and **HATCH** , **Fig. 70**. To rename, expand **Solid Bodies**  folder in the Feature Manager. Slowly click twice over **Split1**  and key-in **CHASSIS** or use the F2 key. Repeat and rename **HATCH**.

Step 3. Save  (Ctrl-S).

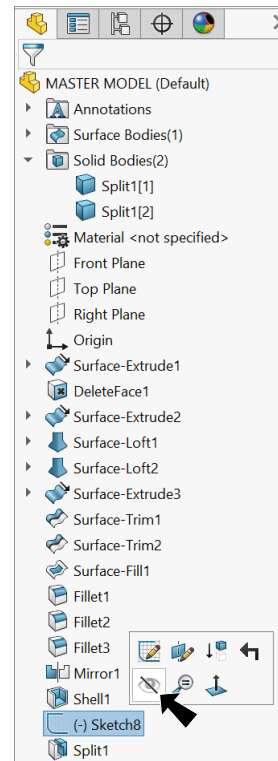


Fig. 69

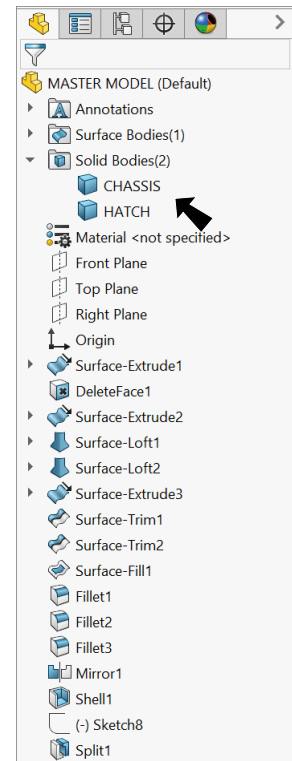


Fig. 70

T. Appearance: Blue Plastic.

Step 1. Click **Isometric**  on the Standard Views toolbar. (Ctrl-7)

Step 2. Click part, click **Appearance Callout**  on the context toolbar and click **MASTER MODEL** , Fig. 71.

Step 3. In the Appearances Task pane, expand **Plastic**, click **Medium Gloss** and in the lower pane select **blue medium gloss plastic**, Fig. 72.

Step 4. Over in the Appearances Property Manager:
 under Color, Fig. 73
 set **RGB values**
R 132
G 142
B 165
 and OK .

Step 5. Save  (Ctrl-S).

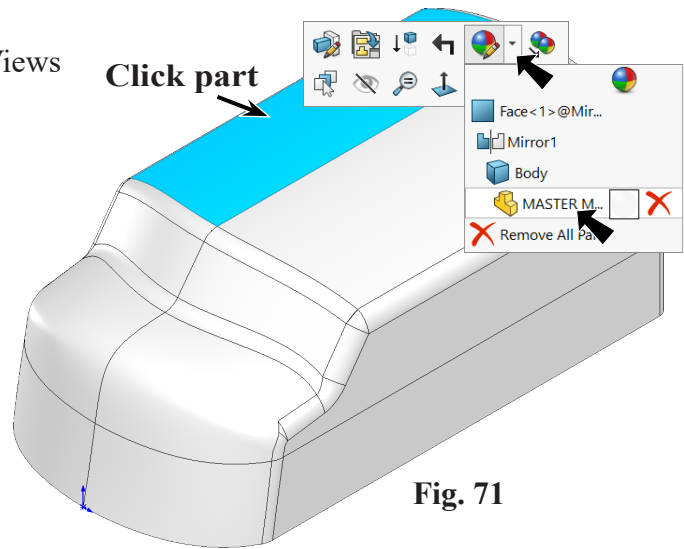


Fig. 71

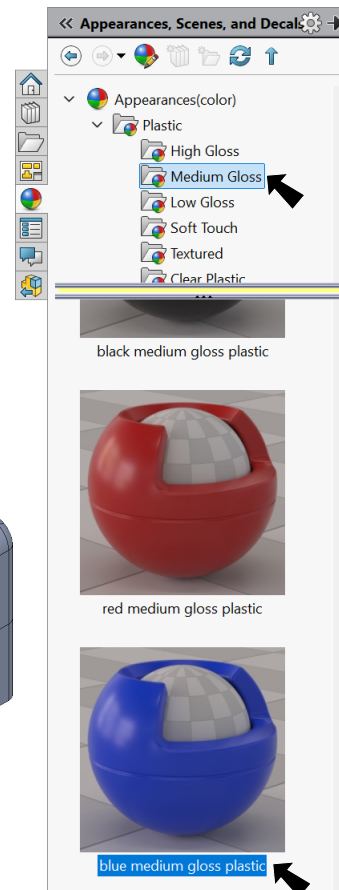


Fig. 72

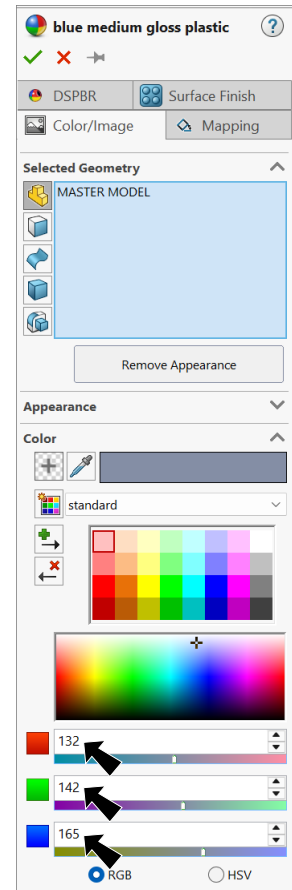


Fig. 73

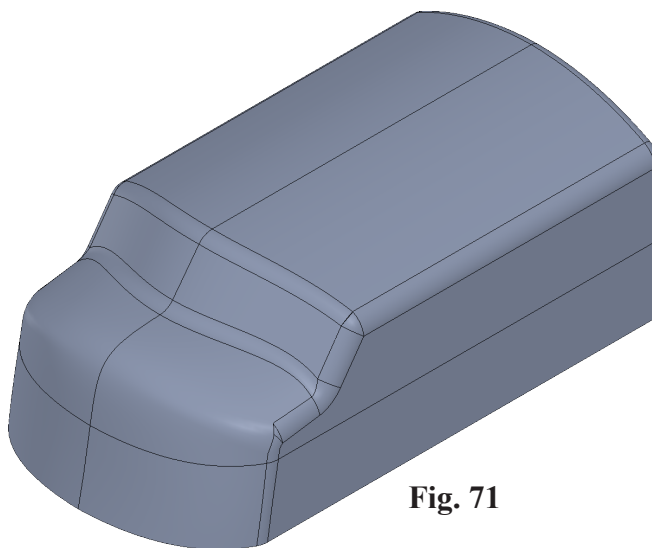


Fig. 71

U. Save Bodies.

Step 1. Click Insert Menu > Features > Save Bodies.

Step 2. In the Save Bodies Property Manager:

under Create Assembly, **Fig. 75**

click **Browse** **Browse...** button

in the Save As dialog box, **Fig. 76**

key in **LOCOMOTIVE ASSEMBLY** for file name
navigate to **My Documents/Tech Ed 26-27/Solar Train**
folder

click **Save**

under Template Settings

set **Part and Assembly template preference** to your **Metric**
templates

under Resulting Parts

click **Auto-assign Titles** **Auto-assign Titles** button

check **Propagate visual properties**

click OK .

SOLIDWORKS creates two Part files and an Assembly file, **Fig. 78**.

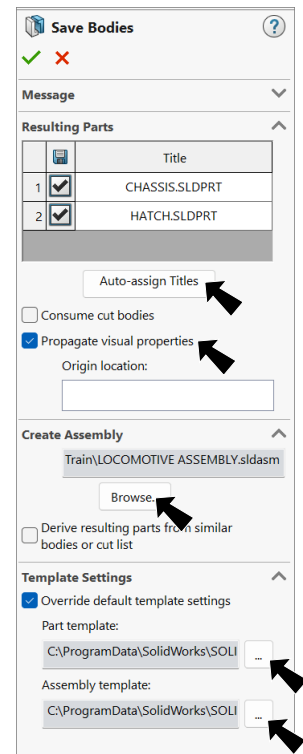


Fig. 75

Step 3. Save  (Ctrl-S).

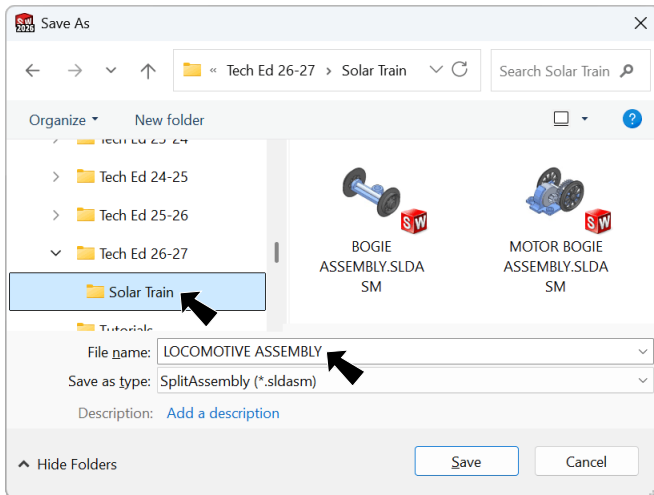


Fig. 76

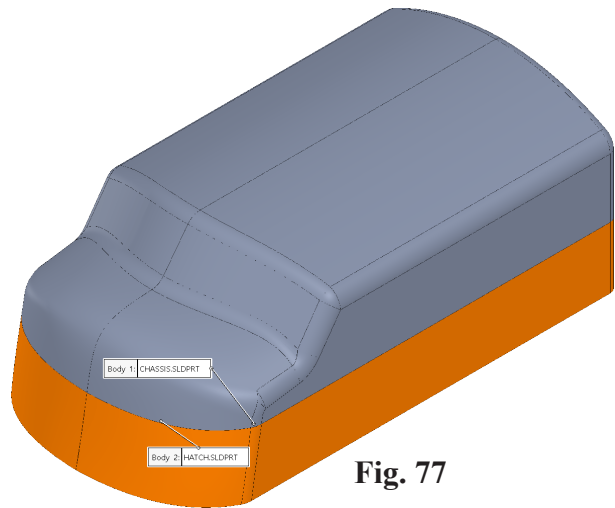


Fig. 77

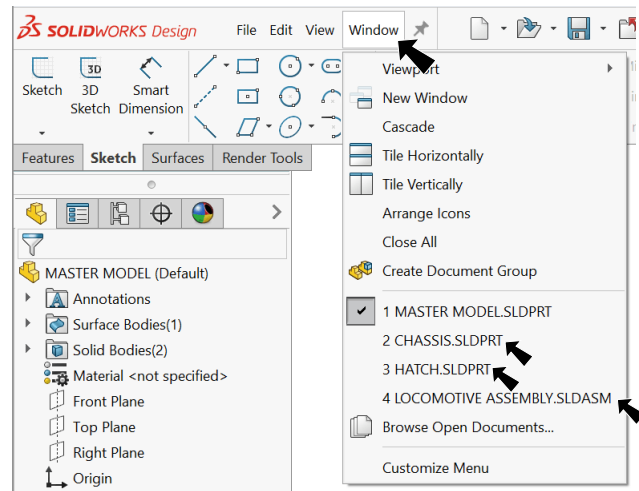


Fig. 78