Assembly Modeling
with
SolidWorks 2001Plus/2003
A Competency Project Based Approach
Utilizing 3D Solid Modeling
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## Project 3
Top Down Design – In Context

Below are the desired outcomes and usage competencies based upon the completion of this Project.

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<td>PLATE-B Part.</td>
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<td>Configurations for the GUIDE-CYLINDER, SLIDE-TABLE and 2AXIS-TRANSFER Assemblies.</td>
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Notes
Project 3 – Top Down Design – In Context

**Project Objective**

Create the 2AXIS-TRANSFER Assembly. Design the PLATE-B Part in context of the GUIDE-CYLINDER and SLIDE-TABLE Assemblies.

Create configurations for the following SMC assemblies:

- GUIDE-CYLINDER.
- SLIDE-TABLE.

Create configurations for the new 2AXIS-TRANSFER Assembly.

**Project Situation**

The 2AXIS-TRANSFER Assembly is the second sub-assembly for the 3AXIS-TRANSFER Assembly. Develop the second sub-assembly.

The 2AXIS-TRANSFER Assembly combines the GUIDE-CYLINDER Assembly and the SLIDE-TABLE Assembly.

The SLIDE-TABLE Assembly vertically lifts the GRIPPER two fingers 100mm.

The GUIDE-CYLINDER Assembly moves 100mm horizontally.

The SLIDE-TABLE Assembly cannot be fastened directly to the GUIDE-CYLINDER Assembly. Design the PLATE-B Part as an interim part to address this issue.

Create the configurations for the GUIDE-CYLINDER, SLIDE-TABLE and 2AXIS-TRANSFER sub-assemblies to represent physical positions.
**Project Overview**

Develop the 2AXIS-TRANSFER Assembly.

The 2AXIS-TRANSFER Assembly consists of the following items:

- GUIDE-CYLINDER Assembly.
- PLATE-B Part.
- SLIDE-TABLE Assembly.
- SHCS.

PLATE-B is a new part developed in context of the GUIDE-CYLINDER Assembly.

Create two configurations for the GUIDE-CYLINDER Assembly. The GUIDE-CYLINDER Configurations are named Normal and Extended.

Create two configurations for the SLIDE-TABLE Assembly. The SLIDE-TABLE Configurations are named Normal and Extended.
Combine the GUIDE-CYLINDER Normal Configuration and Extended Configuration with the SLIDE-TABLE Normal Configuration and Extended Configuration to create the following four 2AXIS-TRANSFER Configurations:

1. Normal-Normal.
2. Normal-Extended.
3. Extended-Normal.
4. Extended-Extended.

The GUIDE-CYLINDER Configuration is listed first, followed by the SLIDE-TABLE Configuration.

Create the fifth 2AXIS-TRANSFER Configuration named Fastener. SHCS are unsuppressed in the Fastener Configuration. SHCS are suppressed for the other four configurations.
Top Down Design Assembly Modeling Approach

In the Top Down Design assembly modeling approach, major design requirements are translated into assemblies, sub-assemblies and components. You do not need all of the required component design details. Individual relationships are required. There are two methods to begin a Top Down Design Assembly approach:

- Method 1: Start with a Layout Sketch in the assembly.
- Method 2: Start with a component in the assembly.

Use Method 2 in this project. Use Method 1 in Project 6.

All major components are positioned based upon a 2D sketch. Relationships between sub-assemblies must be maintained for proper fit.

Use Method 2 for the PLATE-B Part.

Develop the PLATE-B Part with an existing component in the GUIDE-CYLINDER Assembly. The PLATE-B Part contains In Context Relations.

An In Context Relation is a reference between a sketch entity in a part and an entity in another part. Relations that are defined in context are listed as External references.

In Context relations and External references are powerful tools in the design phase. Begin with an empty part and utilize existing components in the assembly. Determine the geometric and functional requirements of the part.
Assembly modeling techniques with in context features requires practice and time. Planning and selecting the correct reference and understanding how to incorporate changes are important. Explore various techniques using In Context Mates and External references developed in context of another part.

### Assembly Modeling Techniques with In Context Mates:

1. Plan the Top Down Design method. Start from a Layout sketch or with a component in the assembly.

2. Prepare the references. Utilize descriptive feature names for referenced features and sketches.

3. Utilize InPlace Mates sparingly. Load all related components into memory to propagate changes. Do not use InPlace Mates for purchased parts or hardware.

4. Group references. Select references from one component at a time.

5. Ask questions! Will the part be used again in a different assembly? If the answer is yes, do not use In Context Mates. If the answer is no, use In Context Mates.

6. Will the part be used in physical dynamics or multiple configurations? If the answer is yes, do not use In Context Mates.

7. Examine how to redefine External references. Use List References and Lock References to locate and protect geometry. Existing references do not update in a locked state. Locate the locked references. Create new references for the sketch and the feature.

8. Reduce the size of the FeatureManager. Hide Update Holders for in context features.

9. Work in the Edit Part mode to obtain the required external references in the assembly. Create all non-referenced features in the Part, not in the assembly.

10. Obtain knowledge of your company’s policy on In Context Mates or develop one as part of an engineering standard.

Note: Using the Break All command causes External references from updating.

Note: The Break All command is not utilized in this project. The authors prefer other techniques based upon experience.
SolidWorks Tools and Commands

The following SolidWorks Assembly tools are utilized in this project:

- Hide/Show Component
- Suppress
- Edit Component
- Mate
- Smart Mate
- Move Component
- Rotate Component

Other SolidWorks tools and commands are utilized in this project:

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Create the 2AXIS-TRANSFER Assembly

Create a assembly called 2AXIS-TRANSFER Assembly. Determine the specific features required to create the PLATE-B Part using the Top Down Design approach. PLATE-B is created as a new part, in context with the GUIDE-CYLINDER Assembly.

1) Close all documents. Click Window, Close All.

Create the 2AXIS-TRANSFER Assembly.

2) Click File, New. Select MY-TEMPLATES. Click the ASSEMBLY-MM-ANSI icon. Click OK.

3) Save the Assembly. Click Save. Select DELIVERY-STATION-PROJECT for Save in: file folder. Enter assembly file name. Enter 2AXIS-TRANSFER. Click Save.

4) Set the System Property to select a custom templates. Click Tools, Options, System Options, Default Templates. Click Prompt the User to Select Document Template. Click OK.

5) Open SolidWorks Explorer within SolidWorks. Click Tools, SolidWorks Explorer. Click Browse. Click GUIDE-CYLINDER from the SMC|MGPM50-100 file folder. Right-click on the GUIDE-CYLINDER assembly name. Click Open file in SolidWorks.

The Hide All Types view option is activated by default in the Large Assembly Mode. Deactivate the Large Assembly Mode and uncheck Hide All Types to display reference geometry.

Display the Reference Geometry.

6) Deactivate the Large Assembly Mode. Click Tools. Uncheck Large Assembly Mode.

7) Display the Origin. Click View. Uncheck Hide All Types. Click View, Origin.
Add the Base Component:

8) Insert the GUIDE-CYLINDER Assembly. Click **Tile, Horizontal**. Drag the GUIDE-CYLINDER assembly icon to the assembly **Origin** of the 2AXIS-TRANSFER FeatureManager. Press the **H** key to Hide All types (Planes, Origins, Axis). Minimize the GUIDE-CYLINDER Assembly. Maximize the 2AXIS-TRANSFER Assembly. Click **Isometric**.

Rotate the GUIDE-CYLINDER Assembly.

9) Remove the Fixed state. Right-click the GUIDE-CYLINDER Assembly from the 2AXIS-TRANSFER FeatureManager. Click **Float**.

10) Click the GUIDE-CYLINDER Assembly icon from the FeatureManager. Right-click **Move Component** from the Graphics window. Right-click **Rotate Component** from the Graphics window. Select **By Delta XYZ** from the Rotate drop down list. Enter 90° for \( \Delta Y \). Click **Apply**. Click **OK**.

11) Fix the component to the Assembly Origin. Right-click the GUIDE-CYLINDER Assembly from the 2AXIS-TRANSFER FeatureManager. Click **Fix**.

12) Expand the GUIDE-CYLINDER. Right-click the MGPTube Part in the Graphics window. Click **Hide Component**.
13) Expand the MGPRod Part. Click **Plus**. Click **Shaded**. Click the **right face** of the Plate in the Graphics window. The Plate Extruded feature is highlighted in the FeatureManager. The four MountHoles2 positions required for the PLATE-B Part are displayed.

14) Insert the new PLATE-B Part.

   Click **Insert**, **Component**, **New Part**. Select the **PART-MM-ANSI** Template. Select **DELIVERY-STATION-PROJECT** for **Save in**: file folder. Enter **PLATE-B** for the file name. Click **Save**.

15) The Component Pointer is displayed on the mouse pointer. The PLATE-B component is empty and requires a sketch plane. Click the **right face** of the MGPRod Part in the FeatureManager. The sketch plane of the component is Mated with the right face of the MGPRod Part. The InPlace1 Mate is created. Sketch1 is the active sketch. The Edit Part icon is active.
Components added in context of the assembly automatically receive an InPlace Mate within MateGroup1. The InPlace Mate is a Coincident Mate created between the PLATE-B Front Plane and the MGPRod front face. The PLATE-B Part is fully defined by the InPlace Mate.

No additional Mates are required to position the PLATE-D Part. The PLATE-B Part is added to the FeatureManager with an InPlace1 (GUIDE-CYLINDER, PLATE-B) Mate.

The system automatically selects Edit Part when a new component is inserted. The PLATE-B text appears in the FeatureManager. The PLATE-B text is displayed in red. The red color indicates that the part is actively being edited.

The right face of the MGPRod Part is the current Sketch plane. The current sketch name is Sketch1. The name is indicated on the current Graphics window title.

Example:

“Sketch1 of PLATE-B - in- 2AXIS-TRANSFER.”

PLATE-B is the name of the component created in context of the 2AXIS-TRANSFER Assembly. The system automatically selects Sketch.

External references to the GUIDE-CYLINDER Assembly are created in Sketch1 with the Convert Entities Sketch tool. The Update Sketch1 entry in the PLATE-B placeholder is listed at the bottom of the FeatureManager.

Create the Extrude Base for the PLATE-B Part.

16) Create Sketch1. Convert existing outside edges. Click the right face. Click Convert Entities.

17) Hold the Ctrl key down. Select the four MountHole2 circles. Click Convert Entities. Release the Ctrl key.

18) Extrude Sketch1. Click Insert, Base, Extrude from the Main toolbar. Enter 15 for Depth. Click OK.
19) The name of PLATE-B is displayed in red. The PLATE-B Part is edited in context of the 2AXIS-TRANSFER Assembly.

Return to the 2AXIS-TRANSFER Assembly.

20) Right-click Edit Assembly 2AXIS-TRANSFER in the Graphics window.

21) Right-click PLATE-B in the Graphics window. Click View Mates. The Inplace1 Mate lists the component references; GUIDE-CYLINDER<1> and PLATE-B<1>.

22) Display the MGPTube Part. Right-click MGPTube from the FeatureManager. Click Show Component.

23) Display the Feature Toolbar. Click View, Toolbar, Feature.

24) Save the 2AXIS-TRANSFER Assembly. Click Save.

Review External references in PLATE-B.

25) Open PLATE-B. Right-click PLATE-B in the Graphics window. Click Open PLATE-B.

26) The "->" symbol indicates that there are External references for the PLATE-B Part. Right-click PLATE-B. Click List External Reference. The External Reference list contains the Feature, Data, Status, Reference Identity and Feature Component. All External references are defined. Click OK.
Three types of External references are created for the PLATE-B Base-Extrude Sketch1.

- Convert Face.
- Convert Edge.
- Arc.

There are four Convert Edge references. The four Convert Edge references are created during Convert Entities of the MGPRod’s right face. The four Convert Edge references are:

1.) Bottom Horizontal Line.
2.) Right Vertical Line.
3.) Top Horizontal Line.
4.) Left Vertical Line.

There are four Arc references. The four Arc references are created during the Convert Entities of the four MountHoles2 circles.
Hole Selection

Four $\varnothing 10$mm fasteners are required to mount the PLATE-B Part to the GUIDE-CYLINDER Assembly. Should the holes be counter bored? Answer: No. The holes are too close to the edge of the PLATE-B Part.

Examine the SLIDE-TABLE Assembly to determine the fastener type. Are additional holes required to mount the SLIDE-TABLE Assembly to PLATE-B? Answer: Yes. Add two additional holes. Utilize an External reference to determine the location for the additional holes.

Hide the GUIDE-CYLINDER Assembly.

27) Press Ctrl-Tab to return to the 2AXIS-TRANSFER Assembly. Hide the GUIDE-CYLINDER Assembly. Right-click GUIDE-CYLINDER in the Graphics window. Right-click Hide Components. PLATE-B is displayed. Note: Do not suppress the GUIDE-CYLINDER Assembly. The Mates will be suppressed and the GUIDE-CYLINDER Assembly is no longer constrained.

Open the SLIDE-TABLE Assembly.

28) Open SolidWorks Explorer within SolidWorks. Click Tools, SolidWorks Explorer, Click Browse. Click SLIDE-TABLE from the SMC\MXS25L-100B file folder. Click Open.

29) Right-click the SLIDE-TABLE assembly name. Click Open file in SolidWorks.
There are two major SLIDE-TABLE Parts:

1.) MXSL-Body.
2.) MXSL-Table.

Determine the SLIDE-TABLE/MXSLBody Part Thru Hole locations.

30) Hide the SLIDE-TABLE/MXSL-Table Part. Right-click SLIDE-TABLE/MXSL-Table in the FeatureManager. Right-click Hide Components.

31) View the Hole locations. Right-click the SLIDE-TABLE/MXSLBody Part in the FeatureManager. Click Set to Resolved. Double-click the ThruHoles on the MXSLBody. Expand the MXSLBody to view the ThruHole sketch. Double-click the ThruHoles Sketch from the FeatureManager. The ∅6.6mm holes are spaced 35mm apart and 32mm from the MXSLBody Top face. Click BodyThruHole4 and BodyThruHole5 to display the Thru Hole feature.

32) Display the SLIDE-TABLE/MXSL-Table Part. Right-click the SLIDE-TABLE/MXSL-Table in the FeatureManager. Right-click Show Components.

33) Display an Isometric view. Click Isometric.

Tip: Minimize the use of External references from multiple parts. Multiple part references lead to problems in higher levels of the assembly, or if additional sub-assemblies are created for other projects.
Utilize BodyThruHole 4 and BodyThruHole 5, closest to the bottom face. Create two M6 Cbore Holes in the PLATE-B Part that correspond to the ThruHoles position in the MXSLTable. No External references are created.

**TIP** Do not create new features in an assembly if no External references are required. Create new features in a Part. Work in a Part. A Part is less complex than an Assembly. Rebuild time is quicker in a part than in an Assembly.

Add Cbore Holes to the back face of the PLATE-B Part.

34) Open the PLATE-B Part. Click **Window, PLATE-B**.

35) Click the **Back** view. Click the **back face** above the Origin. Click the **HoleWizard**. Click the **Counterbore** tab. Create Cbore Hole 1. Select **ANSI Metric** for Standard. Select **Socket Head Cap Screw** for Screw Type. Select **M6 SHCS**. Select **Through All** for Depth. Click **Next**. Cbore Hole 1 is displayed in orange. Orange is a preview color.

36) Create a Cbore Hole 2. Click a **position** below the Top plane, aligned with the Origin. The center point of Cbore Hole 2 is displayed in blue. Note: Blue indicates that dimensions and relations are required.

37) Add a Vertical relation. Right-click **Select**. Hold the **Ctrl** key down. Click the **Hole1 center point**, **Hole2 center point** and the **Origin**. Click **Vertical**. Release the **Ctrl** key.

38) Add a Symmetric relation. Click **Centerline**. Sketch a **horizontal centerline** from the **Origin** to the **midpoint** of the right vertical line. Right-click **Select**. Hold the **Ctrl** key down. Click the **centerline**, **Hole1 center point** and **Hole2 center point**. Click **Symmetric**. Release the **Ctrl** key.
39) Click Dimension. Add a vertical linear dimension between the Hole1 center point and the Hole2 center point. Enter 35. The hole center points are fully defined. Click Finish.

40) Click Isometric. The Cbore Holes are created from the back face.

41) Save the PLATE-B Part. Click Save.

42) Return to the 2AXIS-TRANSFER Assembly. Click Window, 2AXIS-TRANSFER. The message, "Models contained within the assembly have changed. Would you like to rebuild the assembly now?" Click Yes. PLATE-B changed by adding two Cbore Holes. The 2AXIS-TRANSFER Assembly contains the PLATE-B Part. Update the 2AXIS-TRANSFER Assembly to reflect the two new Cbore Holes.

43) Right-click the GUIDE-CYLINDER Assembly. Click Show Components.

44) View the Cbore Hole in the 2AXIS-TRANSFER Assembly. Click the Front assembly plane. Click View, Display, Section View. Flip the view direction. The Cbore Holes are on the back face of the PLATE-B Part.
Section views of components create access to hidden faces and edge. Create a Short Cut key, “S” to invoke Section view.

45) Create a Short Cut key for the Section view. Click Tools, Customize, Keyboard. Select View for Categories. Select Section View for Commands. Enter S for Press new shortcut key. Click the Assign button. Click OK.

46) Display the full view. Press the S key. The Section view dialog box is displayed. Display the Full view. Click OK.

47) Save the 2AXIS-TRANSFER Assembly. Click Save.

Insert the SLIDE-TABLE Assembly.

48) Click Window, Tile Horizontal. Drag the SLIDE-TABLE assembly icon into the 2AXIS-TRANSFER Assembly. Click a position in front of the PLATE-B Part. Maximize the 2AXIS-TRANSFER Assembly.

49) Right-click the SLIDE-TABLE Assembly in the Graphics window. Right-click Move Component. Right-click Rotate Component. Click a position for the SLIDE-TABLE Assembly in front of the PLATE-B Part.

Position a component in its approximate orientation before creating a Mate.

Hide components when not required. Do not suppress the GUIDE-CYLINDER Assembly. Suppressing components suppresses Mates. The GUIDE-CYLINDER Assembly is free to rotate and translate.
There are many holes on the MXSL-Body Part. What holes do you assemble to PLATE-B? Answer: The two bottom holes on the MXSL-Body Part.

Investigate the physical behavior of the SLIDE-TABLE Assembly. What part moves and what part is static? The MXSL-Table Part linearly translates and the MXSL-Body Part is fixed.

Assemble the SLIDE-TABLE Assembly to the PLATE-B Part. Select BodyThruHole4 and BodyThruHole5 from the MXSL-Body Part. Hide the GUIDE-CYLINDER Assembly.

Hide the Components that are not required.

50) Select the component to hide. Expand the SLIDE-TABLE Assembly. Click the **Plus** icon. Hold the **Ctrl** key down. Click MXSL-Table. Click the GUIDE-CYLINDER Assembly in the FeatureManager. Right-click **Hide Components**. Release the **Ctrl** key.

51) Pin the View Orientation dialog box. Create a New view. Hold the **Shift** key down. Press the **Right Arrow** key. Release the **Shift** key. Click **New View**. Enter **Back Iso** for view name. Click **OK**.

Create three Smart Mates.

52) Create the first Smart Mate. Right-click **SmartMate**. Double-click the SLIDE-TABLE MXSL-Body back face. Click **Isometric** from the pinned View Orientation dialog box. Click the PLATE-B front face. The Coincident1 Mate is created.

53) Create the second Smart Mate. Click **Isometric** from the pinned View Orientation dialog box. Double-click the bottom **BodyThruHole5 conical face**. Click **Back Iso** from the pinned View Orientation dialog box. Click the bottom **PLATE-B Cbore conical face**.
54) Create the third Smart Mate. Double-click Isometric from the pinned View Orientation dialog box. Double-click the BodyThruHole4 conical face. Double-click Back Iso from the pinned View Orientation dialog box. Click the top PLATE-B Cbore conical face. Click OK.

55) Save the 2AXIS-TRANSFER Assembly. Click Save.

Fasteners

Two different lengths of fasteners are required for the 2AXIS-TRANSFER Assembly.

- Insert two M6x1.0 SHCS fasteners between the PLATE-B Part and the SLIDE-TABLE Assembly.
- Insert two M6x1.0 SHCS fasteners between the PLATE-B Part and the GUIDE-CYLINDER Assembly.
- Create an assembly-sketched pattern for the fasteners.

Inserting fastener components simulates the assembly process in manufacturing. Assemble the PLATE-B Part to the SLIDE-TABLE Assembly.

Add two M6x1.0 SHCS between the PLATE-B Part and the SLIDE-TABLE Assembly.

56) Display the Top view. Click Top.

57) Measure the thread length distance. Click Tools, Measure. Click the inside edge of the PLATE-B Cbore Hole. Click the bottom edge of the hole. The Delta X distance is 57.00. Utilize a 50mm thread length for the SHCS.
58) **Rotate PLATE-B.** Click the top Cbore hole. Right-click **Zoom to Select.**

59) **Insert a M6 SHCS.**

   Click the Toolbox/SE Browser from the bottom of the FeatureManager.

60) **Insert the first SHCS.** Drag the Cap (B18.3.1M) icon into the assembly Graphics window. Release the mouse pointer on the top CBORE face. The Socket Head Cap Screw Properties dialog box is displayed. Enter M6 for Size. Enter 50 for Length. Click OK. The SHCS is positioned into the CBORE Hole with Concentric and Coincident Mates.

61) **Insert the second SHCS.** Drag the Cap (B18.3.1M) icon into the assembly Graphics window. Release the mouse pointer on the bottom CBORE face. The Socket Head Cap Screw Properties dialog box is displayed. The values are the same as the previous SHCS. Click the Use Existing button. Click OK.

Two instances of the M6x1.0x50 SHCS have been added to the FeatureManager. The B18.3.1Mx6x1.0x50Hex SHCS<1> is the first instance. The B18.3.1Mx6x1.0x50Hex SHCS<2> is the second instance. Each time you insert a SHCS, the instance number is incremented. Your instance numbers may be different if a SHCS was deleted.

62) **Hide the SLIDE-TABLE Assembly and M6 SHCS.** Hold the Ctrl key down. Click SLIDE-TABLE, B18.3.1Mx6x1.0x50Hex SHCS<1>, B18.3.1Mx6x1.0x50Hex SHCS<2> from the FeatureManager. Right-click Hide Components. Release the Ctrl key.

63) **Display the GUIDE-CYLINDER Assembly.** Right-click GUIDE-CYLINDER, Show Components.

64) **Save the 2AXIS-TRANSFER Assembly.** Click Save.
The 2AXIS-TRANSFER Assembly requires four M10 SHCS to fasten the PLATE-B Part to the GUIDE-CYLINDER Assembly. What is the required thread length? Use a 30mm thread. The 25mm SHCS thread does not provide the min. engagement of 75% for the MGPRod Plate hole.

Modify the SHCS. Utilize Edit Toolbox Definition. Create a Local Assembly Pattern that corresponds to the MountHoles2 positions.

Add one M10x1.5 SHCS to PLATE-B.

65) Insert an M10x1.5 SHCS. Click the Toolbox/SE Browser from the bottom of the FeatureManager.

66) Drag the Cap (B18.3.1M) icon into the Assembly Graphics window. Release the mouse pointer on the top edge of the lower left hole. The Socket Head Cap Screw Properties dialog box is displayed. Enter M10 for Size. Enter 25 for Length. Click OK.

67) Click the Front face. Press the S key to display the Section view. Enter 8 to display the Section view with the hole and fastener.

68) Modify the length. Right-Click SHCS M10x25<3>. Click Edit Toolbox Definition. Enter 30 for Length. Click OK.

69) Display the Full view. Press the S key.
Create a Local Pattern.

70) Expand the GUIDE-ROD Assembly. Expand the MGPRod Part. Double-click MountHoles 2.

Record the dimensions between the holes. The Local Assembly Pattern of the M10 SHCS requires the 130mm and 40mm dimensions.

Identify the location of the pattern. The pattern is located at the top level of the 2AXIS-TRANSFER Assembly. The SHCS fastens PLATE-B to the GUIDE-CYLINDER Assembly.

Create a Local Assembly Pattern.

71) Select the B18.3.1Mx10x1.5x30Hex SHCS from the FeatureManager for the seed component. Click Insert, Component Pattern. Click Define you own pattern (Local). Click the horizontal edge for First Direction. Enter 130 for Spacing. Enter 2 for Instances. Click the vertical edge for Second Direction. Enter 40 for Spacing. Enter 2 for Instances. Click Finish.
72) **Expand the SLIDE-TABLE Assembly.** Right-click the **SLIDE-TABLE.** Click **Show Component.**

There is a visual interference between the lower right fastener and the SLIDE-TABLE Assembly. What is the solution? Utilize the second set of MGPRod M6 holes, named MountHoles.

73) **Delete the M10 SHCS and Local Pattern.** Hold the **Ctrl** key down. Click **M10 SHCS** and **LocalPattern1** in the 2AXIS-TRANSFER FeatureManager. Press the **Delete key.** Release the **Ctrl** key.

Create two M6 holes.

74) **Hide the SLIDE-TABLE and the GUIDE-CYLINDER/MGPTube.** Hold the **Ctrl** key down. Click the **SLIDE-TABLE** and the **GUIDE-CYLINDER/MGPTube** in the FeatureManager. Click **Hide Components.** Release the **Ctrl** key.

75) **Edit PLATE-B in context of the 2AXIS-TRANSFER Assembly.** Right-click **PLATE-B** in the FeatureManager. Click **Edit Part.** The PLATE-B Part name is displayed in red.

76) **Click the Right view.** Create the plane for the first hole. Click the **PLATE-B face.** Click **Hole Wizard.** Select the **Cbore tab.** Select **ANSI Metric** for Standard. Select **Socket Head Cap Screw** for Screw Type. Select **M6** for Diameter. Select **Through All** for Depth. Click **Next.**

77) **Display the hidden lines.** Click **Hidden in Gray.**
78) Position the second M6 hole center point. Drag the mouse pointer over the right MGPRod/MountHole circumference. The center point of the right MGPRod/MountHole is displayed. Click the right MGPRod/MountHole center point.

79) Add a Concentric relation. Hold the Ctrl key down. Click the first hole center point and the left MGPRod/MountHole. The hole center points are fully defined. Click Concentric. Release the Ctrl key. Click Finish.

80) Display the M6 Cbore Holes. Click Isometric.

81) Return to the 2AXIS-TRANSFER Assembly. Right-click Edit Assembly:2AXIS-TRANSFER in the Graphics window.

82) Save the 2AXIS-TRANSFER Assembly. Click Save.

Two M6 SHCS are sized and inserted with SolidWorks Toolbox. This action is an exercise at the end of the project. The four outside mounting holes are not deleted. The four holes will be utilized in a different assembly.

Suppress and Display Components.

83) Suppress all fasteners. Hold the Ctrl key down. Select M6x1.0x50 SHCS<1> and M6x1.0x50 SHCS<2>. Right-click Suppress. Release the Ctrl key.

84) Display the Hidden components. Right-click the GUIDE-CYLINDER/MGPTube Part in the FeatureManager. Click Show Components.