

# MasterCam Training Syllabus

## Day 1

### I. MasterCam Configuration/Settings:

- Operating PC, Hardware Accelerations Settings
  - Typically Second Mark from Left on Slider Bar
    - *To Access Hardware Settings:* Go to Desktop > Right Click > Select Properties > Select Settings > Select Advanced > Select Troubleshoot > Adjust Hardware Acceleration Slider bar.
- HELP Option
  - Use feature for learning assistance.
    - Also, use quick learning mode (Hover Mouse cursor over icons on screen to see popup that tells function of particular icon or button)
  - Explain Update Feature which checks for software updates
  - Explain Zip2 go Feature which is used for technical support reasons
- *MasterCam Settings/Configuration* (SETTINGS > CONFIGURATION or ALT + F8)
  - Most commonly altered settings per user
    - Setup Colors
    - Setup Default Machines
    - Start/Exit (Setting to personal Settings)
  - How to Save/Exit Custom Config file.
  - How to Load exist custom file and set to default

### II. Screen Layout:

- *Toolbar display* (Type MRU in HELP menu for greater details)
  - *Select:* SETTINGS > Toolbar States
  - Show how Toolbars can be moved about screen to desired location
- *Status Bar* (Located Bottom of Screen)
  - 3D/2D
  - GVIEW (Graphics View)
    - Explain Various Views
      - **Only Router Pro Students:** Explain “View By Entity”
        - Used Two lines to create New GView for Tool Control or Designing purposes
      - **Only Router Pro Students:** Explain “Normal View”

- Used One line to create New GView for Tool Control or Designing purposes
      - Be sure to select “Normal” line at base to project arrow away from part
  - PLANES
    - Use for construction of geom. **DO NOT USE** for creating new tool Control Lines or views
  - Z Depth
  - Colors
    - Changing Colors
  - Levels
    - Changing Levels
  - Attributes
    - Changing Attributes
    - Explain how Attribute dialogue can be used to change Color, Line type, Layer etc....
- *Right Click Menu*
  - Zoom./Unzoom
    - *Explain common optional features:* F1 (Zoom Window), F2 (Zoom previous)
- *Operations Manager*
  - Briefly Describe that it is to be used for managing toolpath information.

### III. Intro. to Creating CAD Geometry (Sketch geom. on screen on demand)

- Using CREATE Option (Explain that Yellow input fields allow input with math functions)
  - Lines (All)
  - Circles/Arcs (All)
    - Tangent Entities
  - Points (All)
  - Rectangles
  - Rectangular shapes
  - Polygons
  - Ellipses
  - Bounding Box (2D)
  - Letters
  - Splines
    - Manual
    - Automatic
    - Curves (*Only Router Pro Students*)
      - Used to apply wireframe geom. to existing surfaces
    - Blended (*Only Router Pro Students*)
      - Typically used to attach arcs in 3D space
        - Use Magnitude to Adjust

- Fillets
- Chamfers
- Primitives (*Only Router Pro Students*)
  
- Using ANALYZE option
  - Explain how this feature can also be used as Editing Feature
  
- Using EDIT > Trim/Break option
  - Trimming Entities
  - Breaking Entities
  - Extending Entities
  
- Using XFORM option
  - Translate
  - Rotate
  - Mirror
  - Scale
    - Uniform/XYZ
  - Offset Contour
  - Offset
  - Transform Rectangular Array
  - Drag
  - Stretch
  - Nesting: Rectangular/Tru-Shape
    - Explain Groups/Resulting Colors
    - Explain how to Clear Colors (Right Click > Clear Colors)

## Day 2

**Note:** This is Last Day for MasterCam Router Entry Students.

### **IV. Creating 2D MasterCam - Toolpath file**

- *Distribute and Load post files*
  - Post files
    - .PST (C:\McamX2\router\posts)
    - .TXT (C:\McamX2\router\posts)
  - Machine Files
    - .Control (C:\McamX2\cnc\_machines)
    - .RMD (C:\McamX2\cnc\_machines)
- Setup Tools in Tool Manager
  - Create Tool File per customer
    - *Select:* TOOLPATHS > Tool Manager
- Machine Type
  - *Select:* MACHINE TYPE option
    - Explain this can be setup through Configuration Defaults so that when file is opened, machine group will already exist in Operations manager.
  - Once Machine Type is Loaded - Explain PROPERTIES of Machine Group
    - *Go to Operations Manager Select:* Machine Group > *Select:* PROPERTIES
      - Explain Tool Setup
        - “Assign Tool Numbers Squentially”
          - Be sure this is **NOT Checked**
      - Explain Stock Setup
        - Displays stock based on user input
        - Allows visual for Verify Feature
- Applying Tool Paths to 2D Parts
  - Open and explain “Basic-2D\_1.MCX” drwg file
  - Use “MACHINE\_CONFIG.MCX” to explain Merge File option and to show customer how they can use a machine config. Drawing to help them understand part position relative to machine work envelope and use this file as a template. If there are some common toolpaths which will be used, those toolpaths can be added to the machine config file and this file used as a Template type file (will be able to load file and simply reselect Toolpath geom. and Regenerate).
    - Explain Back Plotting feature
      - Note that backplot movements can be saved as actual geom.
    - Show Verify feature

- Explain Ability to Edit Toolpath Parameters & Selected Operation Geom.
  - Show ability to Turn visibility of Tool Paths ON/OFF
  - Explain Regeneration of “Dirty” Operations after they’ve been edited
  - Explain Ability to Post CNC code
    - Drilling
      - Automatic
      - Entities
      - Window Points
      - Mask on Arc
      - Sorting Methods
    - Pocketing (Standard)
    - Contour (2D)
      - Ramp Contour Tool path
    - Circle Tool paths/Circle Mill
  - Hand out Hard copy of “Basic-2D\_1.MCX” drwg file and let student/s work through project, helping them as needed.
    - Use Additional “2D” sample drwgs. if needed for time filler and additional explanation of toolpath options.
- Working with Toolpath geom. in Operations Manager
- Copying Toolpaths
    - Allows user to copy existing toolpath and alter settings to fit a similar geom.
      - *Select: Toolpath to Copy > Right Click > Select: Copy > Reposition Red Arrow to desired location > Select: Red Arrow > Right Click > Select: Paste*
  - Importing
    - Allows user to Import Toolpath Parameters from another MCX file
      - *Select: Toolpath to Copy > Right Click > Select: Copy > Reposition Red Arrow to desired location > Select: Red Arrow > Right Click > Select: Paste*
  - Creating a New Toolpath Group
    - Allows user to manage Toolpaths in greater detail (ie: create a group for fixture machining, group for part trim, etc...)
      - *Select: Machine Group in which you want to create a new Toolpath Group > Right Click > Select: Groups > Select: New Toolpath Group*
  - Transforming toolpath
    - Allows user to Translate and Copy existing toolpath throughout material sheet

- *Select:* Desired Tool Path Operation > Right Click > *Select:* Router Toolpaths > *Select:* Transform

## Day 3

**Note:** This is Last Day for MasterCam Router Students.

### **V. Creating 3D MasterCam - Toolpath file**

- Intro to Three-dimensional Drawing
  - Explain 1" Selection grid for ease of following 3D design
    - *Select:* SCREEN > *Select:* Screen Grid Settings
    - Set Grid to 1" size with .05 grid
    - Return to Graphics screen, change PLANES to show reaction with visible Grid
  - Use CREATE option to draw sample shapes in different PLANES
  - Draw 3D wireframe part
    - Open/Explain "3D\_Wireframe-1.MCX"
      - Create part by first drawing 2D profile, then sweeping geom. into 3D part using the XFORM > Translate > JOIN feature
    - **Note:** For Router students planning to use the 4th Axis/Aggregate
      - Use various PLANES (ie: Front, Side, etc...) to create tool planes for creating Horizontal boring, Mortising, tool paths
  - Hand out Hard copy of "3D\_Wireframe-1.MCX" drwg file and let student/s work through project, helping them as needed.
  - **Note:** At this time For Router Pro Students (Skip to next topic: Surfaces for router Students):
    - Continue Applying toolpaths to "3D\_Wireframe-1.MCX"
      - Create and Save a User-defined Gview/Construction Plane/Tool plane (Normal GVIEW)
        - Display this option on angled face of BLOCK
      - Toolpath part
        - Pocketing from Top
        - Pocketing On Angle (Using newly defined tool plane)
        - Contour Slot (Using newly defined tool plane)
        - Drill Hor. Hole (Using Right Side tool plane)
- Intro to Surfaces
  - Open/Explain "3D\_Surfaces-Router.mcx"
    - Create & demonstrate various primary surface methods
    - Ruled/Lofted Surfaces
      - Differences between Ruled/Lofted
    - Revolved Surfaces
      - Draw profile off to side and revolve geom. around a line designated as center axis to show this option
    - Swept Surfaces
    - Net Surface

- Draw closed boundary shape to show this option
    - Draft Surface
      - Extend one of the wire frame entities of “3D\_Surfaces-Router.mcx” to show this option
    - Extruded Surface
      - Draw profile off to side and extrude to show this option
    - Flat Boundary Surface
      - Draw closed boundary shape to show this option
  - Secondary Surface Operations
    - Offset surfaces
    - Fence surfaces
    - Fillet Surfaces
    - Trimming Surfaces
    - Extending Surfaces
  - Projecting curves onto surfaces
    - Draw entity or shape above surface of part and project to surface of existing part
  - Importance of Surface Normals & how they affect surface fillets, offset surfaces, and head orientation (5 axis machining)
  - Projection normal lines from surfaces
    - Create a point on angled surface
      - CREATE > Point > Dynamic
    - Use XFORM > XFORM Project to create line
  - Vertical (TOP PLANE) Toolpaths
    - Surface Rough
      - Discuss Drive surfaces
      - Check surfaces
      - Tool Containment boundaries
      - Depth limits
    - Surface Finish Tool paths
      - Finish parallel
      - Finish scallop
      - Finish leftover
      - Finish Pencil
  - Hand out Hard copy of “3D\_Surfaces-Router.mcx” drwg file and let student/s work through project, helping them as needed.
  - **Note:** At this time For Router Pro Students Move onto “3D\_Surfaces-Router\_Pro.mcx” file
- Continue 3D Design/Entry to 5 axis machining
- Open Explain “3D\_Surfaces-Router\_Pro.mcx” file
  - Create wireframe



- Create surfaces
  - Offset Surface
- Create Points Dynamic
  - For displaying 5 axis drill
- Create Circle above part to show geom. projection to cut hole through part

## **Day 4**

- Finish any remaining surface machining 3D designing functions cut short on Day 3.
- Multi Axis Surface Toolpaths
  - Use “3D\_Surfaces-Router.mcx” &/or “3D\_Surfaces-Router\_Pro.mcx”drwg file
    - Illustrate Multiaxis Surfacing Toolpaths
      - 5 Axis Multi Surface
        - Note that Multi Surface performs most everything Flowline does
        - Show How Flowline can be changed in ToolPath Parameters of Multi Surface
      - 5 Axis Flowline
- Multi-Axis Trim Paths
  - Use “3D\_Surfaces-Router\_Pro.mcx” file to Illustrate
    - 5 Axis Curve
      - Variety of tool axis control methods, e.g., lines surface, etc.
      - Variety of entry/exit strategies
      - Step increment vs. chord height wall following methods
    - 5 Axis Swarf
      - Variety of tool axis control methods, e.g., lines surface, etc.
      - Variety of entry/exit strategies
      - Step increment vs. chord height wall following methods
  - 5 Axis Drill
    - Create points on surface of part
      - CREATE > Point > Dynamic
  - Discuss Misc. Values and there affects on Posted Code
    - Hand out and explain “PostDocXMR1&2-5AX-R1.pdf” file
      - *MISC values Located in:* Toolpath Parameters

### **Day 5**

1. Cover any additional topics of interest to the customer.
2. Can be used to review or finish third or fourth day topics not sufficiently covered due to lack of time, etc. Work with the students on any real world projects brought to class.