

**SolidWorks
WORLD 2009**

real learning

Exploring the SolidWorks API

Leonard Kikstra, Designer / CAD Administrator
RITE-HITE Corporation, Milwaukee, WI

<http://www.LennyWorks.com/SolidWorks> <http://designsmarter.typepad.com/LennyWorks/>

Who Am I?

Product Designer

- Engineering since 1982.
- CAD user since 1991.
- SolidWorks user since 1998.

CAD Admin & PDM Admin

- 20+ CAD users on site.
- Advise other sites.

Productivity Gains - I want to:

- Simplifying my job.
- Make my computer do more work for me.
- Get the most out of the tools I use to do my job.

Certified SolidWorks Professional (CSWP) 2007

SolidWorks User Group

- SMART (SolidWorks Milwaukee Area Resource Team)
- <http://smart-wi.lennyworks.com>
- Active member since 1999.

LennyWorks Website (since 2003)

- Lenny's SolidWorks Resources
- Free SolidWorks Macros
- SolidWorks Tips & Tricks

LennyWorks Blog (since 2007)

- Personal experiences with SolidWorks
- SolidWorks Macros
- Enterprise PDM

Programming

- Over 50 SolidWorks macros.
- Most of these are available for free on the Internet.

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What is covered here?

EXPLORE

- Macro Recorder.
- Typical Macro Process.
- SolidWorks API Object Model.
- User interaction
- SolidWorks API Help file

EXPERIMENT

- Try to duplicate SolidWorks functions or features
- Use macro recorder to record advanced options of common features

CREATE

- Example Macros

```

Dim sApp = CreateObject("SolidWorks.Application")

' Make sure that there is a model to edit the page no. If there
is no model, you will get an error message to not proceed.
If sApp.ActiveDoc Is Nothing Then
    MsgBox "No model loaded."
Else
    Dim Part = sApp.ActiveDoc
    Dim sPage = "DocPage1"

    ' Create or open a model
    If Part.IsOpen Then
        Part.Save2 sPage
    Else
        Part.Open2 sPage
    End If

    ' Open the document
    Dim sDocName = "C:\Program Files\SolidWorks Corp\SolidWorks\Tutorial1\SolidWorks\SolidWorks1.sldprt"
    Dim sDocPath = Path.GetDirectoryName(sDocName)
    Dim sDocFile = Path.GetFileName(sDocName)

    Part.Open2 sDocPath & sDocFile

    ' Close the document
    Part.Close2 sPage

    ' Save the document
    Part.Save2 sPage

    ' Close the document
    Part.Close2 sPage

    ' Close the application
    sApp.Quit
    
```

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EXPLORE: Macro Recorder

How to record:

- Plan your steps
- Turn on the Macro Recorder
- Complete the steps
- Turn off the Macro Recorder
- Save the macro

Play back recorded steps:

- Launch "Run Macro"
- Select macro

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EXPLORE: Typical Macro Process

- Initialize Variables
- Attach to SolidWorks
- Attach to Document
- Retrieve Data From Model
- Present Data To User
- Wait For User Input
- Process User Request
- Clean Up After Yourself
- Close Macro

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EXPLORE: Interaction With User

Visual Basic Form or PropertyManagerPage

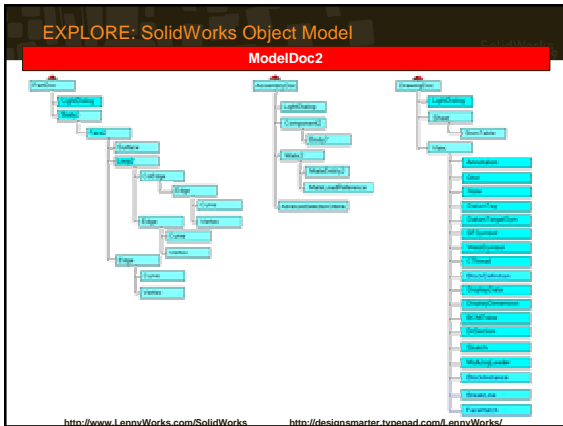
Visual Basic Form Beginner

- User created with WYSIWYG utility.
- More flexible with more options.
- Easier to understand and program.
- Can display lots of information to user.
- Large form can get in the way.

PropertyManagerPage Intermediate

- User Created
 - Manually setup page (no form creation interface)
 - Requires user programmed PageClass and PageHandlerClass.
 - Requires "SolidWorks Exposed Type Library for Add-In use".
 - More complex to keep track when using multiple objects in form.
 - If part of large form is hidden, user may not see all information.
 - Out of the way.
 - Looks and feels like it's part of SolidWorks
 - See SolidWorks "VBA_PropertyManagerPage.swp" example

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- ### EXPLORE: SolidWorks API Help File
- Many Examples**

 - Accessing documents
 - Open Document
 - Read existing data
 - Reload model
 - Selection Sets
 - Sketches & Blocks
 - Component States
 - Resolved / Suppressed
 - Component Visibility
 - Shown / Hidden

More Examples

 - Traversal Routines
 - Assembly Components
 - Part Features
 - Drawing Views
 - Feature Tree
 - Lighting
 - Reference Geometry
 - Mate Groups
 - Annotations
 - Add components
 - Compare
 - Documents
 - Features
 - Geometry
 - PDMWorks Workgroup
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- ### EXPERIMENT: Discover and Learn
- Examples from SolidWorks API Help file
 - Download examples from SolidWorks' website
 - Download macros from user websites
 - Step thru code to understand how the macro completes the task
 - Make changes and observe the effect of the changes
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- ### EXPERIMENT: Discover and Learn
- Use "Debug.Print" to output data to "Immediates" window in macro editor
 - Use macro recorder to record tasks
 - Test "What If" scenarios
 - Experiments need to complete a specific task. They are a learning and discovery tool.
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- ### CREATE: Quick & Dirty Macros - Settings
- CopyDocSettings**

 - Copies settings from master document(s) to existing document
 - Only change document settings

Challenges

 - How to find master documents
 - Work with multiple file types
 - Separate document settings from SolidWorks settings.

AnnotationsPro

 - Change annotations to match document settings.

Challenges

 - Accessing document settings
 - Work with multiple file types
 - Ignore the SheetFormat in drawing
 - First view of drawing sheet.
 - Incorporate special handling for view titles
 - Each annotation type requires different handling.
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- ### CREATE: Quick & Dirty Macros - Models
- IsoViews**
- Activate standard ISO view
 - Rotate model about model's Y Axis
 - Fit model to graphics window
 - Create a view in model
 - Repeat total of 4 times
- What it does:**
- Creates alternate isometric views that can be referenced in SolidWorks drawings.
- Challenges**
- Cannot create view if it already exists. Delete view before creation.
 - Working with Radians for model rotation.
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CREATE: Quick & Dirty Macros - Sketches

QuickSlot macro

- Preselect line in sketch
- Start recording macro
- Offset command
 - No dimensions
 - Bi-Directional
 - Cap Ends
 - Arcs
- Add dimension
 - Endpoints of last arc created
- Save macro

QuickRectangle macro

- Start recording macro
- Rectangle
- Draw diagonal line
 - Opposite corners of rectangle
- Constrain diagonal midpoint to origin
- Add dimensions

Challenges

- Work with any preselected line
- Find last arc created in sketch
- Get endpoints of last arc
- Locate dimension appropriately

Challenges

- Need list of last 4 points in sketch
- Need list of last 5 lines in sketch
- Locate 2 dimension appropriately
- Consistency enables predictability

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CREATE: Quick & Dirty Macros - Drawings

CenterlineSym

- Create annotation at pre-selected point.
- Set note to <MOD-CL>
- Resize note to highlight in drawing

DelRevTriangle

- Traverse drawing sheets
- Clear/Create selection set
- Traverse drawing views in sheet
- Find annotations with triangle border
- Add annotation to selection set
- Delete selection set

Challenges

- Work with any preselected point

Challenges

- Traversing drawing
- Finding proper annotation
- Managing selection set

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CREATE: Quick & Dirty Macros - Assemblies

ToggleState

- Toggle (suppress/unsuppress) state
- First version -- For Mates Only
- New version -- For Features, Mates and Components
- Works with multiple selections
- Suppressed and un-suppressed mates in same selection set
 - Suppress un-suppressed objects
 - Unsuppress Suppressed objects

MateAlignToggle

- Modify alignment setting mates
- For mates only
- Works with multiple selections
- Based on example in SolidWorks Help File.

Challenges

- Evaluating objects in selection set
 - Features, mates and components only
 - What is suppressed or un-suppressed?
- Build selection sets for later access.
- Suppress first
- Unsuppress second

Challenges

- Evaluating objects in selection set
 - Work with mates only
 - Can mate be flipped?
 - Special handling for each mate type.
- Change each mate one at a time

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CREATE: Useful Examples - Settings

SolidWorksSettings

- Faster access to settings I change frequently.

WindowsExplorerPaths

- Add or clear specific paths from SolidWorks list of search paths

Where Is This Useful?

- Enable or disable searching PDM Vault for documents.

Challenges

- Limited to settings that can be toggles (ON / OFF)

Challenges

- Keep other paths.
- Allow user to edit their preferred paths.

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CREATE: Useful Examples - Sketches

3D Point Cloud

- Read points from test file
- Plot points in 3D sketch

Challenges

- Create new 3D sketch if not already in a sketch
- Read X, Y, Z coordinates from file
- Create point.
- Repeat
- Close sketch after all points created

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CREATE: Useful Examples - Parts

ChannelPMP

- Need interface to modify parts with "Nominal" callouts.
- Use SolidWorks' PropertyManagerPage interface

Challenges

- Storing data for Channel.
- Understanding and implementing SolidWorks' PropertyManagerPage interface

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CREATE: Useful Examples - Assemblies

AssyComponentCopy

- Copy referenced documents to current directory.
- Useful for bringing documents into PDM Vault

AssyComponentDensities

- Retrieve list of density settings of components in assembly
- For weight verification

Challenges

- Traversing assembly
- Do not attempt to copy files already in same directory as assembly
- Need to exclude copying files from PDM Vault.

Challenges

- Traversing assembly
- Access density setting of each component.
- Display settings in list with model description

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CREATE: Useful Examples - Drawings

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CREATE: Useful Examples - Other

DataCharter

- Change 2 "Driving" dimensions in sketch then retrieve and chart values of 1 "Driven" dimension.
- Each "Driving" dimensions can have multiple values.
- Permit exporting data to text file or Excel.

DataRipper

- Read dimensions on demand and chart values.
- Keep interface on screen while user edits geometry. Do not react to user geometry editing.
- Permit exporting data to text file or Excel.

Challenges

- Allow user to select "Driving" and "Driven" dimensions.
- Allow user to enter multiple values for 2 "Driving" dimensions.
- Unit conversion
 - Angle and Linear dimensions have different conversion factors.

Challenges

- Allow user to select dimensions to chart.
- Keep interface on screen
- Unit conversion
 - Angle and Linear dimensions have different conversion factors.

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CREATE: Useful Examples - Other

RebuildAllConfigs

- Ensure all configurations in model have been properly rebuilt
- Retrieve a list of configurations in the model
- Activate each configuration

RotateViewPro

- Create multiple saved views in model.
- Axis of rotation
 - Model axis
 - Screen Axis
- Degrees of rotation

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CREATE: Useful Examples - Multiple Document Types

ConfigurationManager

- Part
 - Configuration of current document
- Assembly
 - Configuration of current document
 - Configuration of selected component
- Drawing
 - Referenced configuration in all views
 - Referenced configuration in selected views

DeleteConfigs

- Parts and Assemblies only

DocExport

- Drawings to DXF, PDF, etc...
- Models to ACIS, STL, etc...
- Time comparison / benefit
 - 8 hours to write
 - Save 10-12 hours each use
 - Saved 100's of hours

How can this be done in a single macro? Plan Ahead!

- Attach to SolidWorks
- Attach to current document
- Get document type
- Get pre-selection
 - Selection made before launching macro.
- Write separate code for the following:
 - Each document type.
 - With or without pre-selection.

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CREATE: Useful Examples - Other Stuff

Custom Properties Editor

- Type 1: Only edit your properties
- Type 2: Allows editing all properties
- Work with multiple document types
- Ensure your properties exist in document

Global Property Editor

- Rules based
- Edit properties in multiple documents

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CREATE: Code Re-Use

Retrieving Model Data

- **DataCharter** 12 hours
 - Modify values of 2 dimensions
 - Read / chart values of 1 dimension
- **DataRipper** <2 hours
 - Allows user to modify dimensions
 - Reads / charts up to 5 dimension values upon request.
- **Code Re-Use**
 - Reading and changing dimension values
 - Exporting data to text file or Excel
 - Retrieving pre-existing selections
- **New Code**
 - Allow selections after macro started
- Can be a base for many more macros

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CREATE: Code Re-Use

Globally Retrieve or Modify Documents

- **InfoFileBuild** 8 hours
 - Retrieve / chart custom properties of all documents in current directory.
 - Opens models and reads data.
- **FixRevision** 2 hours
 - Ensure "Revision" custom property exists and contains a value.
 - Opens models, checks current conditions, modifies model if needed
 - First in series to modify documents
- **FixAllPartNo** 1/2 hour
 - Clear "Alternate part number on BOM" setting
 - Opens models, checks current conditions, modifies model if needed
- **AddDocumentNo** 1/2 hour
 - Add "Document Number" custom property to all documents in current directory.
 - Opens models, checks current conditions, modifies model if needed
- **PropertyEditorGlobal** 18 hours
 - ~30% of macro built with existing code from FixRevision macro
 - Remaining development time spent on new capabilities and interface.
- Base for many more macros

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CREATE: Interfaces

Document Export

- **Different interface**
 - With document open
 - Without document open (Batch Mode)

CommonNotes

- Interaction between objects on form

FramedBox

- Begin with recorded macro
- Multiple Interface Examples
 - Using VBA style form
 - Using PropertyManagerPage

C-Channel Selector

- Using PropertyManagerPage

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CREATE: External Applications / Documents

Launch other macros.

- **MacroLaunch**
 - List and menu of available macros
 - Different list based on document type or no document open
- **MacroSequencer**
 - Launch macros in specific order
 - Copy Settings
 - Update Annotations

Launch applications.

- Microsoft Word
- Microsoft Excel
- PDM Search Tool
- Etc...

Open Windows Explorer

- Directories of last opened files
- Directories of user specified projects

Open web pages.

- Local or Internet

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CREATE: SolidWorks Examples - Other

<h3 style="text-align: center;">FramedBox</h3> <ul style="list-style-type: none"> • Start recording macro • Create sketch on front plane <ul style="list-style-type: none"> • Add rectangle to sketch • Center rectangle on Origin • Dimension sketch • Extrude midplane • Select top face <ul style="list-style-type: none"> • Create Sketch • Offset preset distance • Cut thru all • Repeat for 2 other faces • Save macro • Add interface to edit dimensions <ul style="list-style-type: none"> • Before model creation • After model creation 	<h3 style="text-align: center;">Challenges</h3> <ul style="list-style-type: none"> • Determine if part is active. <ul style="list-style-type: none"> • If not, start a new part • Temporarily disable automatic inferencing during sketching <ul style="list-style-type: none"> • Reduces unexpected constraints • Be aware of previous geometry created in model <ul style="list-style-type: none"> • Sequential feature naming • Sequential sketch naming • Dimension parameters include feature or sketch names • Different interface types <ul style="list-style-type: none"> • Visual Basic Form • SolidWorks PropertyManagerPages
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TIPS: Learning and creating your own macros

<h3 style="text-align: center;">EXPLORE</h3> <ul style="list-style-type: none"> • SolidWorks API Help file <ul style="list-style-type: none"> • Hundreds of examples • SolidWorks Website <ul style="list-style-type: none"> • Many more examples • Development Kits • Forums • Learn from existing examples. <ul style="list-style-type: none"> • Many available on internet • 3D Content Central • Reseller <ul style="list-style-type: none"> • SolidWorks API Training 	<h3 style="text-align: center;">EXPERIMENT</h3> <ul style="list-style-type: none"> • Macro recorder <ul style="list-style-type: none"> • Record steps • Great discovery tool • Step thru macro <ul style="list-style-type: none"> • Learn how the macro works • Revise macro <ul style="list-style-type: none"> • Observe what happens 	<h3 style="text-align: center;">CREATE</h3> <ul style="list-style-type: none"> • Create your own macros • Macro recorder <ul style="list-style-type: none"> • Obtain pieces of code you need • How do you want it done?
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