

# MultiSurf 5.0 to 6.0 Transition Tutorial

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The change from MultiSurf 5.0 to MultiSurf 6.0 involves the biggest changes in the "look and feel" of the application since the transition from MS-DOS (version 1.5) to Windows (version 2.0), in 1995. Long-term MultiSurf users are likely to feel a bit off balance at first. Some features you are used to may be hard to find, or not there at all. The modes of editing object data and interacting with the model have many similarities, but also many differences. Some things are called by different names.

Most of the changes can best be viewed as modernization of the user interface, and an attempt to be compatible with and similar to modern Windows and mainstream CAD applications, especially SolidWorks. We hope you can see these changes as positive updates, providing productivity gains and convenience. This series of notes, in the form of a tutorial, is intended to ease your transition.

It's important to be aware that the underlying technology (the invention we call Relational Geometry) has not changed at all in this transition (aside from a year's worth of incremental advances). The .MS2 file is still the data repository for all of a model's information. The focus is still on point, curve, surface and solid objects, defined by a rich variety of constructions, and retention of the relationship information that connects them.

## History and Rationale

Let me take a moment to explain how we got to this release. MultiSurf was developed in the early 1990's, as a 3D CAD tool especially adapted to naval architecture and boat design. We knew from the beginning that our novel Relational Geometry foundation could be highly advantageous in many other areas of geometric design. In 1997 we saw the emergence of SolidWorks, a Windows-based solid modeling application, as an opportunity to reach that wider design world. We developed a relational surface modeling application that could operate as a SolidWorks add-on, supplying it with much richer surface definition tools. This product is called SurfaceWorks. Many choices were made in the user interface design to make it as similar to the SolidWorks user interface as possible.

Since 1998 SurfaceWorks and MultiSurf have both been important AeroHydro products. For some years, they were maintained and developed with separate code bases, which sometimes diverged and sometimes converged through cross-pollination; but there was a lot of duplication of effort to maintain the parallel development tracks. It soon became a goal to get them back together, but that didn't happen easily. We reunified the

underlying math/geometry/relationship engine (RGKernel), with the release of MultiSurf 4.8 in 2002, but RGKernel is only about 30% of the total application.

MultiSurf 6.0 marks the reunification of the MultiSurf and SurfaceWorks user interface code. The two products are now a single application, which we configure through licensing to have different names and feature sets according to the market.

Some MultiSurf 5.0 features didn't make it into the first release of MultiSurf 6.0; some of these are on our list for the next release. If you're missing something that's important to you, please let us know ([support@aerohydro.com](mailto:support@aerohydro.com)), to help us with our priorities!

## **Solid Works integration option**

One major potential advantage to be aware of is the new option of Solid Works integration. This has never before been available in MultiSurf, but MultiSurf 6 can function as a SolidWorks add-in, with "bidirectional associativity":

- Surfaces made in MultiSurf can be transferred into SolidWorks and used to build other surfaces and solids.
- Surfaces and faces from SolidWorks can be transferred out to MultiSurf and modified to change the SolidWorks solid model.

So if you're considering adding solid modeling to your CAD system, take a good look at the combination of MultiSurf with SolidWorks intergation.

## **Installations don't overlap**

If you have not installed MultiSurf 6.0, now is the time. The MultiSurf 6.0 installation is completely separate from 5.0; by default it goes into a different folder (Program Files\AeroHydro\MultiSurf6), so you can have both program versions installed at the same time, and run either one, or both at the same time.

(You can have the same model open in both programs at the same time, though we're not enthusiastic about the idea, especially if you plan to Save changes made in either program -- that could get quite confusing. Saving the model in either program will not cause the other program to update.)

## **Fire it up**

Following installation, you should find a MultiSurf 6.0 icon on your desktop; you can double-click the icon to start -- or use Programs/ AeroHydro/ MultiSurf6 on your Start menu.

## **Toolbars galore**

The first screen (with no open model) is mostly gray, except for some mostly grayed-out toolbars at the top. MultiSurf 6.0 has lots of toolbars, making a majority of program features accessible with a single mouse click. View/ Toolbars is the way to turn off the

ones you don't want. They are all dockable, on any side of the screen, so you can rearrange them to your heart's content; pick one up by the "handle" at the left or top of the toolbar and move it to where you want it to be. They can also float in your workspace (like the MultiSurf 5.0 view palette). Your toolbar choices will automatically be saved in the registry, so they will come back as you left them each time you open the program.

In my initial installation, the toolbars were loosely arranged at the top of the screen, taking up 4 rows. I found a suitable layout with View Modify, Mechanical View Orientation, and Marine View Orientation down the right hand side, and the others packed into 2 lines at the top.

If you pause the cursor over any toolbar icon, a ToolTip box will open identifying the function of the button.

## **Open Demo.ms2**

Let's open a model that will put you on familiar ground -- Demo.ms2. File/Open and browse for it; if your installation is standard, you should find it in C:\Program Files\AeroHydro\MultiSurf6\Examples.

## **Screen background colors**

My first reaction is, how pitiful and washed-out it looks on that light gray background! MultiSurf has always defaulted to a dark background, and you'll feel a lot more at home if you'll make that change now.

Select Tools/Options on the menu (or just press 'O' key) to bring up the whole group of option tabs. The one we want right now is Display, so click it. This tab offers several settings for the "Shaded view" and "Wireframe view". Right now, we're only concerned with background colors. In the "Shaded view" panel, background color box, click the "Color" button; you can see you have endless possibilities. For my money, the choice is easy: plain black, in the lower left corner of the grid of premixed colors.

Make this same change in the Wireframe/Background color box, then OK the Options dialog. Ahh-hh! That's more like MultiSurf.

These color settings are also saved in the registry, so you only need to make them once.

## **Default point color**

If you're going to work with a dark screen, one little fact you should be aware of is that, in MultiSurf 6, the default color of 3-D points is black. If you create a black point and display it on a black background, you won't be able to see it. I find it's easy to remember to edit the color to yellow during Insert; the color is displayed right there in the

Properties Manager. Once you've made one yellow point of a given entity type, yellow will be the default color for further points of that type.

## Z-up vs. Free Tumble

While we're setting options, let me point out a new one related to display. Press 'O' again to get back to Tools/Options. On the "General" tab there's a group labeled "Rotation constraint", with radio buttons labeled "Z-axis vertical" and "Free tumble". The "Z-axis vertical" style is what MultiSurf has always used; I predict you'll feel more at home if you choose it. ("Free tumble" is a rotation mode that comes to us from SolidWorks; to me, it sometimes feels appropriate in working on a model representing a small object that I could hold in my hands and turn any which way.)

## Shaded view

Shaded view is the default modeling window for the Surface Works environment. It has a lot of similarity to Wireframe view in previous MultiSurf versions, but one notable difference: surfaces are drawn in a partially transparent/ partially opaque style. This model has only one surface, hull, whose color is a bright green (color 10). In shaded view, it is drawn as if it's made of a partially opaque green plastic, with the mesh lines superimposed on it.

You can rotate this view with the arrow keys (in 10 degree increments, or 1 degree increments if shift is down). However, you'll find that the rotations are opposite what you're used to in previous MultiSurf versions. This will take some getting used to. While the paradigm in previous MultiSurf was that one click of the up-arrow key would raise the **viewpoint** 10 degrees, in the Surface Works environment a useful paradigm is that the axes and model are embedded in a transparent sphere, and one up-arrow keyclick pushes **the near side of the sphere** up 10 degrees.

## Wireframe view

View/ Display/ Wireframe switches the view to a wireframe view, much the same as MultiSurf's. It basically just switches off the drawing of the transparent surfaces. For a complicated model Wireframe view drawing, selection, etc. is noticeably faster than Shaded view.

## Right-button context menus

In previous MultiSurf versions, the right mouse button was reserved entirely for rotating the view. MultiSurf 6 is much more modern and Windows-like in this respect -- the right-mouse button is reserved throughout the program for bringing up a context menu: a set of choices appropriate to the current program mode, view and operation.

In the shaded view, click and release the right button. The menu displayed has about a dozen options, some currently grayed out. The current mouse mode setting is Select,

indicated by a dot next to it. Click on Rotate. (You can use either right or left button for this selection.) The immediate visible effect is to change the cursor to a new symbol, which indicates that the mouse is now in a "Rotate" mode. While in this mode, the effect of the mouse *left button* is to rotate the view. The paradigm is the same as previous MultiSurf -- the axes and model are embedded in a transparent sphere; putting the mouse button down grabs that sphere on the near side; moving the mouse with left button down drags that place on the sphere up, down, left or right; and releasing the left button lets go of the sphere.

Other mouse modes available from the context menu for viewing purposes are **Pan**, **Zoom to fit**, **Zoom to area**, **Zoom in/out**. **Previous** steps back to the previous view (like <F8> has always done in MultiSurf). You should experiment with these modes a little, to see how they work.

If your mouse has a scroll wheel, this offers another way to control the view. Point to a place on the screen and scroll up or down; you zoom in and out on that region of the screen.

Right-button menus are the place to find many other view-specific options that previously were on the main menu, for example:

**Export DXF** in Ship Lines view

**Export OFE** and **Export OF4** in Offsets view

View options (high/low, angle, etc.) in Surface Curvature view

**Save as Text** in Mass properties and Hydro text windows

## Select mode

Press <Home> and use the right-button menu to return to Select mode. Here the cursor is an arrow, and the mouse is used to point to and select entities.

Move the cursor over the model and pause over various objects. A tooltip box will open showing what's under the cursor -- individual points, curves, surfaces, contours in this model. This also shows what you will be selecting if you click the left button in this position. If the selection is ambiguous, "..." will be displayed. (For example, point to where the waterline crosses MC2.)

Selection works pretty much like previous MultiSurf, but there are some differences to be aware of:

- In previous versions, to select a surface, you had to click on one of the edges or mesh lines; now (in shaded view) you can click anywhere in the shaded area of the surface.
- When an entity is already selected, ctrl-clicking it will **remove** it from the selection (rather than adding another copy of it)
- To select a given entity multiple times (not often desirable, but occasionally important), hold **Ctrl and Shift** keys down while picking.

As you select entities, notice that they show up in the Selection Set pane in the left column of the screen. This pane can be resized, both vertically and horizontally, as needed, to see more selected objects, or more information about them. Just position the cursor over the boundary you want to move, where it changes to a "<- | |->" symbol; then left button down, drag and release.

## Click to clear

While working with selection, you should be aware that in MultiSurf 6, clicking in empty space in the shaded or wireframe view clears the selection set. (This has been a settable option in previous MultiSurf versions, but in version 6.0 it's not optional.) Try to learn to click on the caption bar or the frame, to bring a window to the top.

## Terminology and naming conventions

Some important terminology changes have come with the adoption of the Surface Works user interface.

What's always been called an **object** in previous MultiSurf is now called an **entity**. Examples of entities in the Demo model are **Point P11**; **B-spline curve MC1**; **C-spline Lofted surface hull**.

What has been called an **entity** in previous MultiSurf is now called an **entity type**, or just a **type**. Examples of entity types are **Point**; **B-spline curve**; **C-spline Lofted surface**.

MultiSurf 6 uses longer, more descriptive type names for most of the various entity types. For example: **B-spline curve** in place of **BCurve**; **C-spline Lofted surface** in place of **CLoфтSurf**.

What have been called **supports** in previous MultiSurf are now called **parents**. For example, the 5 **parents** of **B-spline curve MC1** are **Relabel \*** and **Points P11, P12, P13, P14**.

What have been called **dependents** in previous MultiSurf are now called **children**. For example, **Contours stations** and **Contours waterlines** are both **children** of **C-spline Lofted surface hull**.

The **Fillet** entity type is now called **BlendSurf**. The former **BlendSurf** entity type is one kind of Tangent Boundary Surface.

What have been called **attributes** in previous MultiSurf are now called **properties**. For example, bright yellow color is a property of all the points in Demo.ms2. Which leads us to...

## Properties Manager

The middle portion of the left column of the screen, headed "Properties", is the Properties Manager window. This replaces the "Edit Attributes" dialog in previous MultiSurf versions. One advantage is that it's always on the screen, allowing you to immediately see (and edit) the properties of whatever is in the selection set.

Click on the hull surface to select it. In the properties manager you will see that this is a C-spline lofted surface; its name is "hull"; its color is bright green; it's visible, it's on layer 0; it's not locked; its degree is quadratic, etc. You can edit any of the properties and see the effect immediately in the graphic view. For example, click once on the color (in the right-hand column, on the line labeled "Color"); this drops down a window showing the available colors; click dark red. The surface color becomes dark red, and is immediately displayed as such in the shaded view.

If you type in a number, you generally have to press <Enter>, or move to a different field, to have the change take effect.

If multiple objects are selected, the Properties Manager shows the properties that they have in common, and similarly allows immediate editing. Clear the selection set and ctrl-click on the three master curves (MC1, MC2, MC3). The Properties Manager shows color, layer, visibility, divisions, subdivisions, etc. Click on the color chip, select bright green, and the color change takes place instantly.

## **Undo/Redo**

Edit/Undo and Edit/Redo are similar to the corresponding functions in previous MultiSurf versions, but there's an important difference in the way they work. MultiSurf 5.0 and earlier versions saved the complete model file (with AS0, AS1...AS9 extensions) for each change in the model. Undo and Redo could be slow operations, because of the need to load the entire file; and Undo was limited to 10 steps.

In MultiSurf 6.0, Undo and Redo have been reimplemented to save only the "deltas" between model versions -- i.e., just the object or objects that changed. This typically makes them much faster, and there is no limit to the number of steps that can be Undone and Redone.

The menu choices Edit/Undo and Edit/Redo give you an indication of what particular change the next Undo or Redo will apply to.

Click the Undo icon enough times to get back to the original model (i.e., where the Undo icon grays out).

## **Entity rollups (where did AbsPoint and RelPoint go?)**

Some entity types that have been in previous MultiSurf have been effectively combined with others and eliminated from the menus. This has taken place with no loss of functionality. AbsPoint and RelPoint are among the missing; these have been replaced

or "rolled up" with the FramePoint entity type, which is just called a Point on the Insert/Point menu.

The key to making this possible is that the Point entity type has all the functionality of the AbsPoint and the RelPoint (and considerably more). Its data includes:

Frame -- the basis frame  
Point -- the basis point  
dx, dy, dz offsets  
Dragging constraint, 0-8

To see this, clear the selection set and Insert/ Point / Point, and examine the fields in the property manager. Then cancel the Insert (red X button).

(**Insert** in MultiSurf 6 is the same as **Create** in previous versions.)

When the basis frame is \* (the global coordinate system), and the basis point is \* (the origin of the basis frame, and therefore the global origin), the resulting Point is just like an AbsPoint, with dx, dy, dz as its global coordinates.

When the basis frame is \* (the global coordinate system), and the basis point is a point entity P, the resulting Point is just like a RelPoint with P as its basis point and dx, dy, dz as its global coordinate offsets.

Similarly, FrameAbsPt and FrameRelPt have been rolled up into Point, which can do everything they did.

One advantage of converting everything to FramePoints is the possibility of changing a point (or especially, a whole set of points) to a new frame.

Another big advantage of FramePoints is that they have a **Dragging constraint** property. Select P21, P22, and P23 and change their Dragging property to "y and z"; select P24 and change its dragging property to "z only". This effectively constrains B-spline curve MC2 to lie in a transverse plane at X = 15, with its end point also constrained to lie in the Y=0 centerplane.

PolarRelPt and PolarPoint entity types have also been rolled up into Point in the Properties Manager. This is through the **Coordinates** property, with choices of **Cartesian** or **Polar**.

AbsBead and RelBead have been rolled up into Bead.  
AbsMagnet and RelMagnet have been rolled up into Magnet.  
AbsRing and RelRing have been rolled up into Ring.  
SubCurve and BSubCurve have been rolled up into SubCurve  
PolyCurve and PolyCurve2 have been rolled up into PolyCurve  
PolySnake and PolySnake2 have been rolled up into PolySnake  
SubSnake and BSubSnake have been rolled up into SubSnake  
ProjSnake and ProjSnake2 have been rolled up into ProjSnake



XContours, YContours and ZContours have been rolled up into Contours. (Use cut type = Offset from Mirror/ surface, and system plane \*X=0, \*Y=0 or \*Z=0 for the Mirror/surface parent.)

XPlane, YPlane and ZPlane have been rolled up into OffsetPlane (Use system plane \*X=0, \*Y=0 or \*Z=0 for the Plane parent.)

## Entity conversions during File/Open

The "rolling up" of entity types is the motivation for some entity conversions that are automatically performed during File/Open (and also File/Component/Load). For example, if the file being read contains any AbsPoints, they will automatically be converted to FramePoint entities with \* as Frame and \* as Point. These conversions are all exact, that is to say they do not involve any approximation, and therefore do not cause the slightest change in the model geometry.

For example, File/open, navigate to your old MultiSurf 5 (or earlier) installation, and in Samples folder find Arc1.ms2, and open it. You'll get the notification: "Some entities were converted for compatibility with this program version. The conversions will only be retained if the model is saved." OK the message box.

Now select the yellow point on the positive Y axis. The property manager reveals that it's a Point, named side; cartesian type, Frame is \* and Point is \*. This was an AbsPoint in the original file; so were the other two points in the model.

File/Close. You get a warning message box: Save changes? This may be a surprise, because we didn't make any deliberate changes. The changes it's talking about are the conversions of the 3 AbsPoints into FramePoints. (I'd recommend responding "No", to avoid changing the sample file.)

Since practically any pre-existing MultiSurf model will contain AbsPoints, and perhaps other entities that are subject to automatic conversion, you can expect to get these conversion warnings when you open any model file that originated in a MultiSurf version prior to 6.0. (Once you have saved the model with the conversions in place, you'll no longer get these warnings.)

## Dragging

A difference to point out in dragging is that just pressing down the left mouse button on a point both selects it *and* initiates a drag. (In MultiSurf 5.0 you have to select the point first.) I find this makes it pretty easy to inadvertently drag a point a little ways when I just intended to select it. Having "Prompt after drag" on (Tools/ Options/ Dragging tab) avoids this problem; if a drag occurs, you are notified and have a chance to cancel it.

## Surface Manager

The upper pane of the left column of the screen is called the "Surface Manager" or "Surfer view". This new feature from Surface Works provides a graphic "tree" view of the model relationships, in addition to a breakdown of the model's entities according to entity class.

Notice at the top there are two tabs, "Parents" and "Children". Make sure you're on the "Parents" tab, and expand Surfaces, i.e., click on the + sign to the left of it. This reveals there's only one surface in the model, hull. Expand hull to see its parents: \*, MC1, MC2, MC3. (\* is the relabel of the C-spline Lofted surface.) Expand MC1; you see its parents: \*, P11, P12, P13, P14.

You can select (and ctrl-select) in the surfer view; the objects go into the selection set.

Switch the surfer view tab to "Children", and start over expanding Surfaces and hull. This reveals the two children of hull: stations and waterlines.

Surface manager is also the place to find "system entities" like \*, \*X=0, \*0, etc. -- under the heading "System" -- when you need to use them as parents.

## Command window

Like previous versions, MultiSurf 6.0 has a Command Window (now on Tools menu) supporting a large number of commands. Commands primarily serve to expose program functions that haven't made it onto the menu, are experimental, or are sufficiently specialized that they are likely to be used infrequently or by only a small percentage of users.

Select Tools/ Command Window, and type:

help

followed by <Enter>. The Help command produces a list of all the available commands in this program version (sorted alphabetically). You can get help on the syntax for a particular command by typing in help, space, and the command keyword; for example: help printBevels

explains what PrintBevels command does, what needs to be selected to use it, and what additional information you can provide to modulate its action.

Most of the commands use the same syntax as in previous versions. One exception is Breaks, which was called Breakpoints in previous versions, but now reports breaklines in surfaces, as well as breakpoints in curves, snakes and graphs.

Previous MultiSurf versions had provisions for executing scripts of commands, but these features have not so far been implemented in MultiSurf 6.0.

Our choices for which commands to include in the 6.0 release were based on our general impressions of command usage among our users. If we missed some that are important to you, please let us know, and we'll get them on a list for a future release.

## Missing in action

**Edit/ Model File** did not make it into the 6.0 release. If you miss it, the workaround is to open the MS2 file in an editor such as Notepad, WordPad or Word. (Find these programs on your Start menu, under Programs or Programs/ Accessories.)

I use Edit/ Model File a lot, but 9 times out of 10 it's just to look, not to actually change anything. Notepad serves perfectly well for this. Of course, you have to remember to save your model first, so that what you see in the editor is the same as the current state of your model in memory.

If you actually need to change something in the model file by editing the text, I'd recommend these steps:

- (1) Save the model under its own name -- say Model001.ms2.
- (2) Save As, under a different name -- say temp.ms2
- (3) Close the model in MultiSurf
- (4) Open temp.ms2 in Notepad; make your modifications; save it. (If editing with Wordpad or Word, use Save As and be sure to save it as text. If using Notepad, text is the only option for saving.)  
(Watch out for Notepad's propensity to append .txt to the filename you specify, as in temp.ms2.txt. If it does this, you must remove the extra extension in Windows Explorer.)
- (5) Open temp.ms2 in MultiSurf, to see if your changes were successful. (Be sure to turn on all layers that have objects you changed.)
- (6) When you're satisfied that temp.ms2 has the changes you intended, you can Save As Model001, overwriting the old version.

**History** did not make it into the 6.0 release. If you miss it, a workaround is to maintain a document for each model (or maybe a single document for all your projects, with a section for each project) where you keep notes about what changes you made, their rationale and purpose, when you saved different versions, when you exported particular files, etc. This is not a bad idea in any case; if you come back to a project after some period of inactivity, this kind of information can make it much easier to pick up the pieces.

**Tools/ Velocity profile**

**Tools/ Graph profile**

**Tools/ Tangency profile**

**Tools/ Clearance Profile**

-- not there, but high on our list for the next version.

**Tools/ Special/ Similar Label** -- not there, but better done now with a Procedural curve

**Tools/ Special/ ArcLength Relabel** -- not there, but better done now with a Procedural curve.

**Tools/ Special/ Freeze Fit** -- not there, but available as FreezeFit command

**Tools/ Special/ BCurveFit** -- not there, but make a Fitted Curve or NUB-Fitted Curve, and use FreezeFit command

## **Features moved to other menus or commands**

**File/Export3D/ PAT, PNL and STL** are available as commands in 6.0 -- File.Export3D.PAT, etc.

**File/ Export3D/ VRML** has been modified to export VRML 2.0 only. VRML 1.0 is still available as an option for the command File.Export3D.WRL

**Select/ Expand ObjectLists** -- for now, it's available as ExpandLists command

**Edit/Replace** has moved to **Tools/ Adopt Children**

**Create/ Copies** is found under **Insert/ Copies**

**Tools/ Curvature Profile** has moved to **View/ Display/ Curvature Profile**

**Tools/ Surface Curvatures** has moved to **View/ Display/ Surface Curvatures**

**Settings/Layers** has moved to **Tools/Layers**, or **accelerator key L**. (Notice new options here for moving and rearranging layers.)

And remember the **right-button menus** in Ship Lines view, Offsets view, Mass properties, Hydro, etc.

MultiSurf 5-to-6.doc