



# FLUID

## SCREENEFFECTS

v2.0

by John van der Zwaag and Christopher Holland

### Documentation

First of all, thank you for using Fluid. We have put quite a bit of work into it and feel that it is one of the best screensavers available for any platform and we hope that you do too.

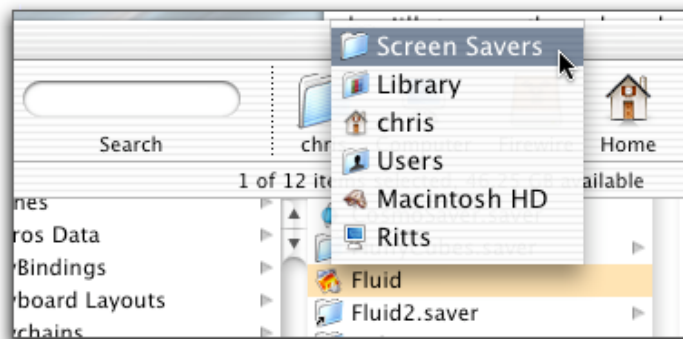
If you want to get the best looking images and performance out of Fluid then it helps to know what all of those controls do. It may look like a ton of options but once you learn your way around it quickly becomes child's play. I'll step you through each of the tabs of controls and help you understand what effects each individual control will have on the rendering of fluid model.

### Installation

To install Fluid drag it to your Screen Savers directory. Which should be at the following location:

`~/Library/Screen Savers/`

The "~" symbol represents your home directory.



*Note:* If you want to install Fluid so that every user on the computer can use it (not just you), then you will need to have administrator access and you should install it in the following location instead of the above:

`/Library/Screen Savers/`

Then start the *System Preferences* application and select the "Screen Effects" or "Screen Saver" item. Next select Fluid from the list of screensavers available to you. That's it. You may click "Configure" if you want to change

how Fluid looks. The details of the controls are below.

If you would like to make your themes available over the local network via Rendezvous you can use the Fluid Theme Server (FTS). The FTS should be installed in the following location (you may need to create the directory if it is not there):

`~/Library/PreferencePanes/`

Now, if you start the *System Preferences* application you should see the FTS item. Select it and click the "Start" button. That's all there is to it. Your Themes should now be shared and you should be able to see them in Fluid if you have networking enabled (see "Expert Tab" below). If you would like for the Fluid Theme Server to start whenever you log in, then select that item and quit *System Preferences*.

## Performance

First, it's important to know exactly what Fluid is. Fluid is a realtime fluid dynamics modeler and renderer. What does this mean? Well, it means that for each frame of animation on the screen the program has computed the reaction and involvement of a "fluid" medium and has then taken that numerical model and produced an image from it using rendering techniques that are commonly used in scientific visualization. Fluid does all of this for each frame of animation. Therefore, if you are getting around 50 frames per second (about right for a dual-proc 867 G4 using a resolution 64 grid...more about this later) then Fluid is recomputing the movement of the liquid and rendering it 50 times each second. This is an incredibly complex task—a task that could have only been accomplished on supercomputers merely five or six years ago.

## Performance Checklist

If you are getting slow performance from Fluid there are a couple of things that can help, in the order in which to try them.

- If you have two graphics cards in your machine then make sure you have selected the "Use main monitor only" option in the Expert tab.



- Lower the resolution for the liquid grid in Fluid. Resolution 64 should run fairly well on just about any machine with a G4.
- Don't include so many Render Effects. Each Effect adds another layer and geometry for your graphics card to deal with.
- If you are using Contours, lower the amount of colors being used in the Colormap.
- If you have a multi-proc machine then make sure you have selected the "Multithread / Multiproc" option in the Expert tab.
- If you have a machine with an Altivec unit (any machine with a G4) then make sure you are using Altivec to handle your math computations via the Expert tab. Otherwise, use the FFTW math library.
- Large amounts of particles can slow down even the most advanced graphics cards out there. The alpha-compositing of all those particles slows it down considerably.

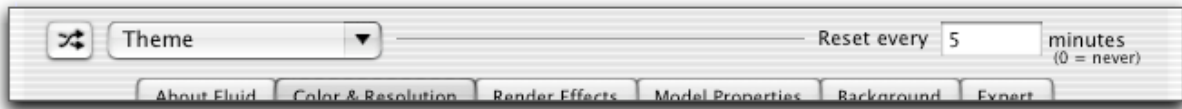
## The Controls

The controls for Fluid are divided into sections to help minimize the clutter. The first section that should be mentioned is the top part that allows you to load settings from a Fluid Theme file.

## Theme Header

### Selecting a Theme

The popup menu allows you to select one of the Fluid built-in themes, a Theme file from disk, or, if you have other Macs on your network that have a Fluid Theme Server running, a Theme from the network. When you select a Theme from the menu it will load all of its settings into the controls for Fluid. You can then change the settings if you would like. If you like the changes that you have made then you can save the Theme to your computer for later use. Once saved to Fluid's Themes directory it will be included in the Themes menu.



The button to the left of the menu is the Randomize Themes toggle. When it is selected it will glow blue and you cannot change any Theme settings in Fluid. Each time Fluid runs it will select a random Theme from any available sources (local files or network based Fluid Theme Servers). A new theme will be loaded each time Fluid resets.

The reset interval can be set using the input field on the right. You can use a value of 0 (zero) to force Fluid to never reset once it starts. When Fluid resets it basically just starts the fluid model again with new random positions and directions. This can be useful since the fluid model can sometimes reach a state of "equalization" over time.

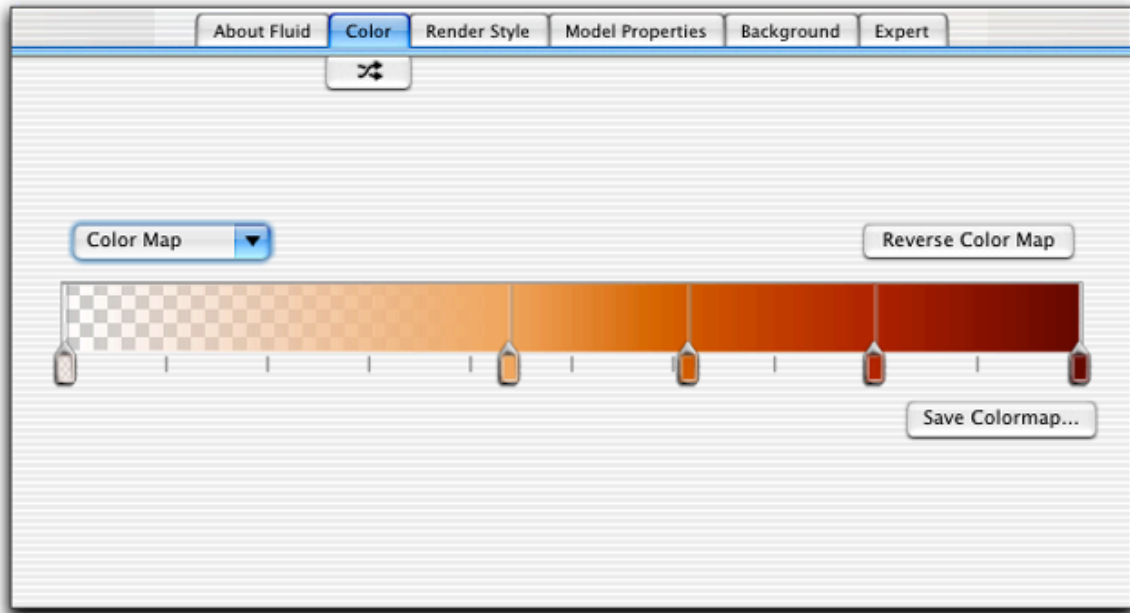
### Rendezvous enabled Fluid Theme Server

If you have a collection of Themes on one computer and would like to have them on other computers that are on the local network then use the Fluid Theme Server. It is a Rendezvous server that allows you to share themes between machines on the network. All of this happens transparently. The Themes just show up in the Themes menu. Pretty cool. More exciting is the fact that network themes will be included if you are using the Randomize Themes feature. Even cooler.

## Color Tab

### Color

The colormap control is a specialized control that allows you to add, delete, move, and edit colors in a "colormap." This colormap will be used by Fluid to colorize the liquid medium based on velocity. Higher velocity colors are to the right.



You may add colors by control-clicking (or right clicking if you have a multi-button mouse) where you want to add them. They will inherit the color that was already there, but you may edit any color by double clicking on its handle. Control-click on an existing handle to delete it or add colors to the right or left of it. Notice that colors can have any amount of transparency that you wish.

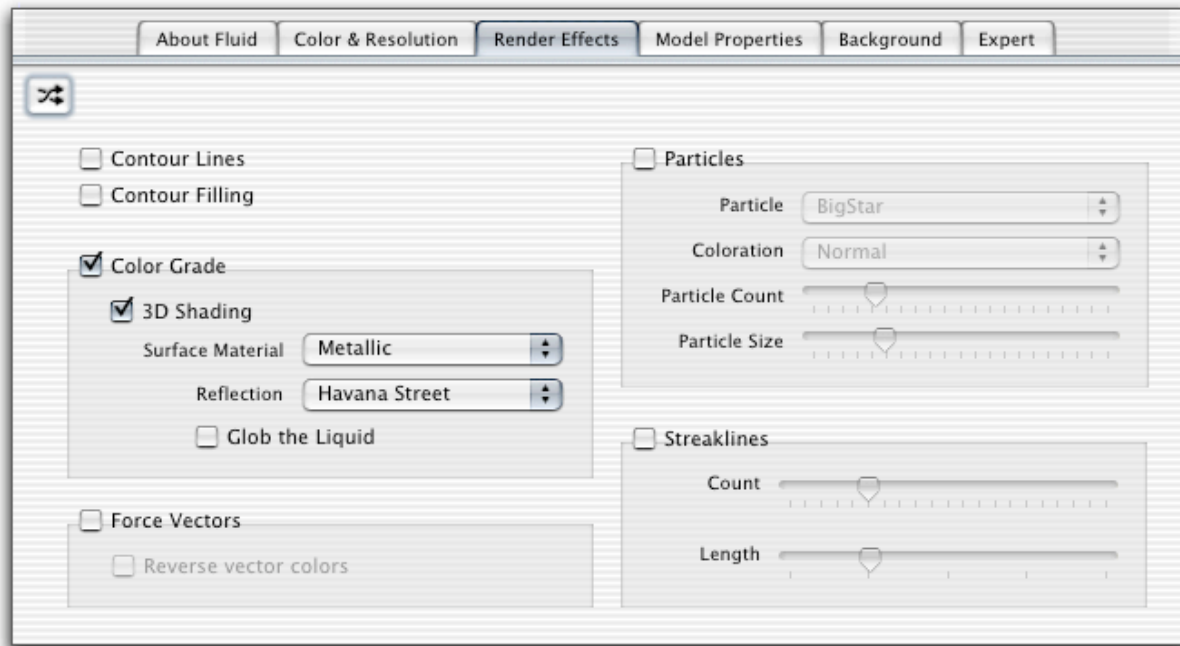
*Shortcut*

Delete a color by option-clicking on its handle.

If you have a colormap that you have created and want to save it for later use (separate from the Theme itself) then you can do that by clicking on the "Save As..." button. The colormap will be saved to the Fluid Color Maps folder and will be automatically loaded in the menu in the future. The colormap will be saved as an OS X standard colorlist and can be used in any other application via the default OS X Color Picker under the Color Palettes section. Again, pretty cool.

## Render Effects Tab

By selecting different render effects you can change how Fluid looks in dramatic ways. This is what makes Fluid so customizable. Each of the effects is separate from the others and none are mutually exclusive. It's up to you to customize Fluid to your tastes.



### Contour Lines & Contour Filling

These options allow the rendering of objects that are much like contour lines on a topographic map. There will be a contour line for each color handle that you have in your colormap (defined in the Color & Resolution tab).

### Color Grade

This is the most common type of render effect—and the one that Fluid uses as a default. It colors the liquid medium per the velocity at that pixel on the screen. You can also apply some additional effects to the color grade option. First of all, you can shade it by selecting the "3D Shading" option. This will create specular highlights and shadows on the liquid to make it look more three dimensional. When you enable shading you will have a selection of material types for the liquid and an option for "globbing" the liquid. When globbing is enabled the liquid will form in small clusters or nodules as it flows—much like mercury does.

#### *Surface Material*

- Plastic – you won't see any reflections and the highlights and shadows will be seen fairly smooth.
- Metallic – you will see reflections on the liquid. The reflection map popup can now be used to select the image that will appear in the reflections.
- Glassblocks – On some graphics cards (Radeon 8500) there will be an option for a glass-block material. This looks best at resolution 64 and has a very nice effect. You will also be able to select a reflection map when this is enabled.

### Force Vectors

Force Vectors will render as small pointers at each of the model's grid locations. The direction of the vector corresponds to the direction of the liquid medium and the length and color of the vector correspond to the velocity of the liquid at that point. You may choose to reverse the colormap for the vectors to better see them against some color backgrounds or if you have colorgrade effects turned on also.

### Particles

Particles offer some very interesting effects for Fluid. At this point we have a group of particle emitters in the

center of the screen. These emitters will constantly shoot out particles that will be swept up by the current of the fluid and will be colored based on their age. The Coloration popup menu allows you to change the way the particles are composited over the background and can dramatically change the way a particle system looks. The Particle Count slider gives control over the number of particles that will be alive at any one time from each emitter. Particle Size is quite self explanatory.

### Streaklines

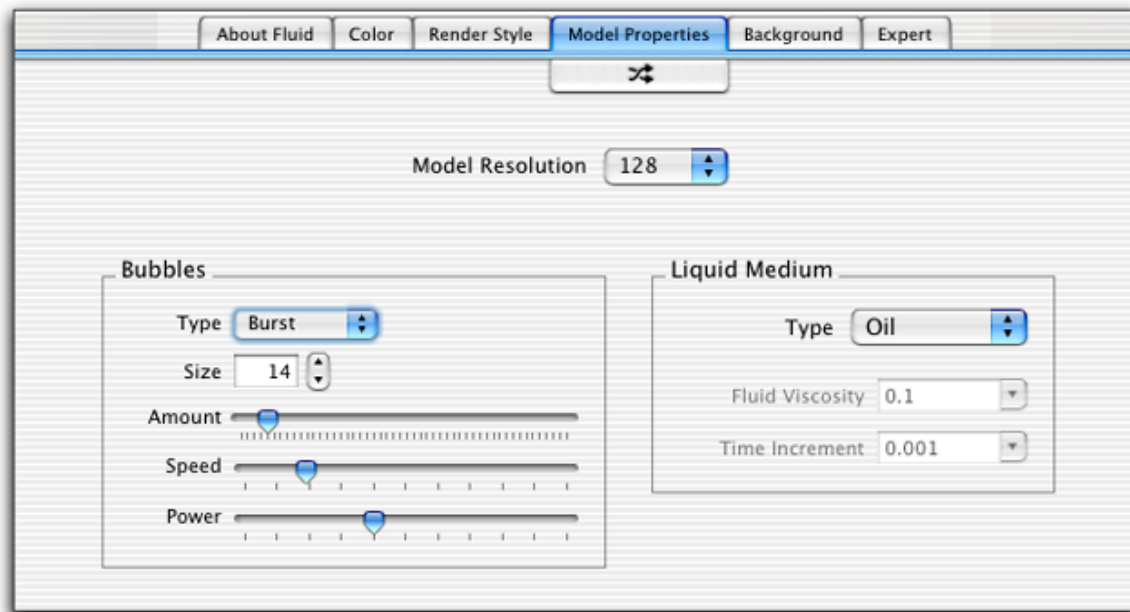
Streaklines are a close cousin of Force Vectors. The main difference between the two is that streaks will stretch, flow, and bend with the current, whereas vectors remain stationary. Also, you may include an arbitrary amount of streaklines regardless of Fluid's grid resolution. The amount of streaks is controlled with the Count slider. The maximum length of the streaks is controlled by the Length slider.

## Model Properties Tab

The properties of the fluid model can be used to directly control how the the behavior of the computational model that drives Fluid.

### Resolution

The first tab that you will see when Fluid start is the "Color & Resolution" tab. The resolution popup menu allows you to control the resolution of the fluid model grid of data. Each step up in grid size will square the amount of calculations being performed each frame. Use it wisely. A resolution of 64 runs above 30 frames per second (fps) on just about any G4 and will approach 60-70 fps on higher end machines. A resolution of 128 will run better than 30 fps on any dual-proc 867 or better. Resolution 256 and above will give you quite beautiful and exquisite renders but may be too slow on all but the fastest Macs. Resolution 1024 is for people who have no regard for speed or who have a black-ops-super-secret-Apple-backroom quad processor G6. But, it will give you incredible renders...at about 1 frame every 2 to 6 seconds.



### Bubbles

The fluid model in Fluid uses "bubbles" to create the current disturbances. The number, size, speed, and power of these bubbles have a profound effect on what the Theme looks like. One large bubble will create big sweeping currents where 30 tiny bubbles will create a bubbling, undulating look. The Type menu changes how the currents come out of the bubble. The Size field determines the size of each bubble. The number of bubbles used in the simulation is controlled by the Amount slider. The average speed of the bubbles is controlled by the

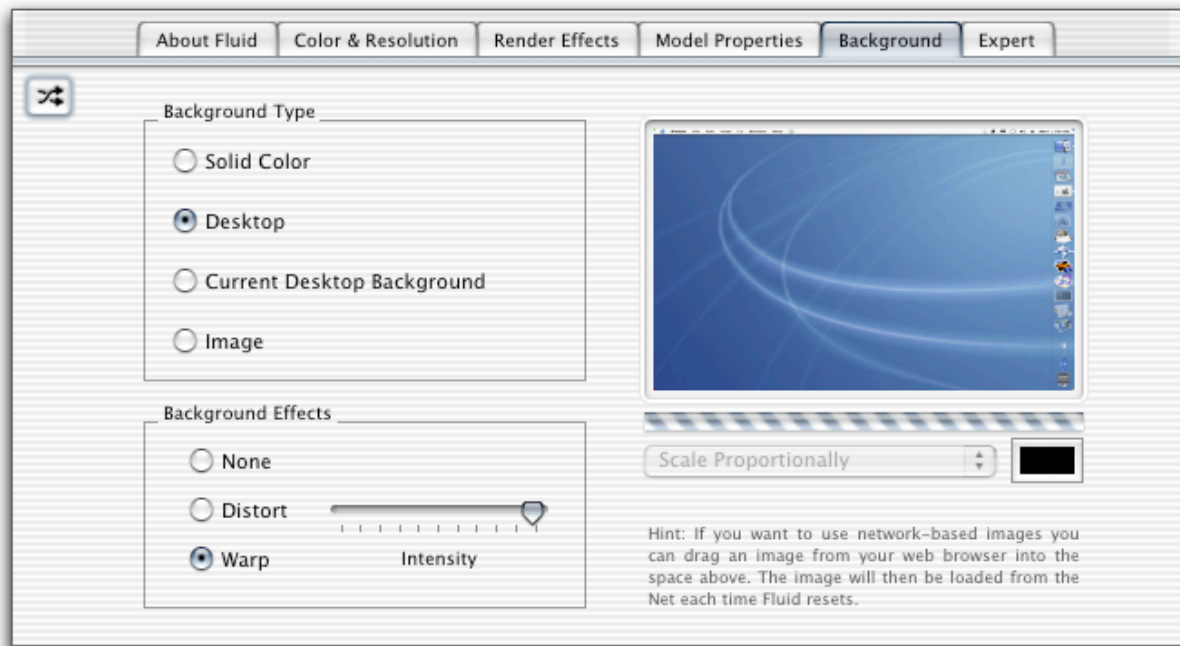
Speed slider. The speed setting is used as base number and the actual speed of each bubble uses a speed just slightly different than the setting to make the model more visually interesting. The power setting is treated much the same and corresponds to the strength at which each bubble sends out currents.

## Liquid

The liquid medium of the computational model can be changed to make it behave like different substances. We have included a couple of presets in the Liquid Medium menu to make it easy on you, but you can select Custom and change the numbers for viscosity and time-increment to anything that you wish.

## Background Tab

This section is fairly self-explanatory but a couple of the options may need a little extra documentation.



## Background Type

Select what type of background you would like to display behind the Render Effects that Fluid will render.

- *Solid Color* – Fluid will use a solid color background. You can change the color by clicking the small color swatch at the bottom of the background preview image.
- *Desktop* – Fluid will take a screenshot of your desktop when it starts and each time it resets. This is a great option to use if you are using rendering options that have transparency to them because you will see your desktop in the background.
- *Current Desktop Background* – Fluid will check with the Finder's preferences and use your current desktop background image as the background image. This is a great setting to use if you are going to run Fluid in the background of the desktop using utilities like BackLight.
- *Image* – You may drop any image you would like onto the background preview area and it will be used as the background image in Fluid. This includes images from your web browser. Images will be reloaded each time Fluid resets, so if you have Fluid set to reset every minute and you have dropped an image

from a webcam that updates every minute then you will have a new background from the webcam everytime Fluid resets. Way cool!

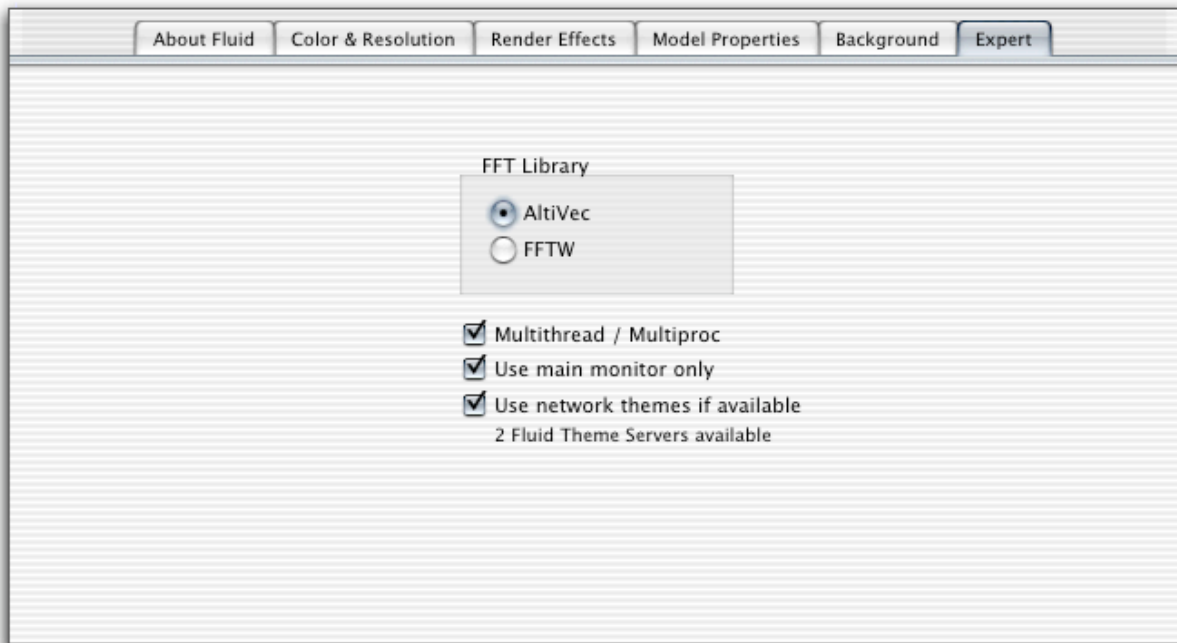
### Background Effects

By using one of the Background Effects you can choose to have Fluid affect your background image too. *Distort* causes each pixel in the background image to be pushed around by the liquid and creates some interesting designs. This is the exact effect that Alias/Wavefront is using for their PC-only Maya Fluid Screensaver. In Fluid, it is but a minor option. Once again the Mac does it better :).

*Warp* causes the background to wave and flow in the liquid but it remains fairly intact. It is much like a flag in the wind.

### Expert Tab

The Expert Tab contains items that most people won't ever have to worry about, or at least will only have to worry about once.



### FFT Library

This is an arcane item that allows you to select the math library that Fluid uses for its computations. It is useful for turning off the use of AltiVec routines on machines that don't have vector processors. It may also be useful for geeks like us who want to know if AltiVec is helping them out any. We can't say that our vector code is the best in the world, but it does give us a slight speed improvement over the non-vector unit code that uses FFTW libraries. Of course, we're sure that if we had access to tools such as VAST that Fluid could be *much* faster than it is now. Apple, are you listening?

### Multithread / Multiproc

This turns on Fluid's multithreading, giving it *tons* more performance on a multi-proc machine. Even on single processor machines you may leave this option on. It doesn't hurt a thing for Fluid to be multithreaded on a single processor. This option is useful to turn off if you are using Fluid as your background during normal work on a multi-proc machine. That ensures that Fluid will never slow you down because it is, at most, going to be using one of your processors at a time (although it may jump between them during use).



### Main Monitor only

This is a very important setting and, until Apple fixes the issues with multiple monitor support and OpenGL screensavers, will probably never be changed from the "ON" position. OS X screensavers that use OpenGL slow to a crawl if you use more than one screen at a time.

### Use network themes if available

This option will only be enabled if you are running OS X Jaguar version or better. It uses Rendezvous technology that debuted with Jaguar to access Fluid Themes from other computers on your local network. These other machines must be running a Fluid Theme Server. If you would like to share your themes with other computers on your network just drop your copy of Fluid Theme Server in your <HOME DIRECTORY>/Library/PreferencePanes/ directory. You may have to create the PreferencePanes directory. Then run the System Preferences application and you should see the Fluid Theme Server (FTS) item at the bottom. Select FTS and start it up. If you want it to run automatically when you login, select the appropriate button. Now others should be able to use your themes.

## Registration

The copy of Fluid that you have is the full version. Nothing has been disabled until you register. That being said, we would appreciate it if you would "register" Fluid by selecting the button in the "About Fluid" tab of the controls. How much you give us for Fluid is up to you. Give us what you think Fluid is worth based on the amount of work put into it and its capabilities. That's all we ask.

If you don't feel like paying us anything then that is up to you.

### Other notes:

When Fluid runs for the first time it will create the following directories for its own use.

```
~/Library/Application Support/Fluid/  
~/Library/Application Support/Fluid/Color Maps/  
~/Library/Application Support/Fluid/Themes/
```

The colormap control that is used in Fluid is a custom Cocoa control called CHColorMapControl written by Christopher Holland of Concept House. For information and download check out the web site: <http://www.concepthouse.com/products/CHAppKit/>

Fluid's fluid model is based on a paper by Jos Stam titled "A Simple Fluid Solver based on the FFT". Journal of Graphics Tools, Volume 6, Number 2, 2001, 43-52.

## Change Log:

### 2.0

- The preview window now always renders in 64 resolution so that it won't chug the machine if somebody sets Fluid to 1024 model resolution or something. It still looks the same in the preview window at the lower res due to the above changes to resolution scaling.
- Turned the color map control to horizontal to allow for it to be bigger.
- We've provided settings for the **viscosity** and **time increment** fields (though you can still use your own via the Custom menu item). This should help people a bit since those are fairly cryptic settings.
- The Fluid model resolution can now only be set to a predefined set of numbers (that are

all fairly reasonable) via a menu. This is to help keep people from setting it to insane numbers thinking that it corresponds to video resolution and not resolution of the model's grid.

- The "Background" tab **preview** now shows what the background will look like in Fluid (complete with background color and all).
- **Backgrounds** can now be **web-based** . Yep. Just open your web-browser and drag an image from a web page onto the background image in Fluid's prefs pane and Fluid will then load that image from the web whenever it starts. This is really cool when using webcam images from the web. I figure that somebody will come up with some interesting uses for this feature. Caveat: Right now it only gets the image when it starts the first time...not on every reset of Fluid. We are working on a fix for that.
- Theme files also now have a **preview in their icon** . One caveat: They use the last rendered frame in the preview window as their screenshot. So, to get a preview, you need to run the preview until you get an image that looks good and then hit 'configure' to open the configuration pane to save the Theme. That's the only way we could do it since the model has to work for a bit to get a good screenshot. Plus, this way you get to pick the screenshot that you want in the icon.
- ColorMap files now have a **preview** of the colormap in their **icon** when saved from Fluid. And, as far as I know, Fluid is the only program that allows you to edit and save OS X's built-in NSColorMap objects. Fluid's colormap files can be loaded directly into OS X's color palette.
- Bubbles now move at the same speed regardless of resolution or framerate.
- Now every setting scales proportionally when changing model resolutions. So, if Fluid is set for resolution 64 and you really like it and want a high res render, then you can just set it to 256 and not have to change things to get it looking right again.
- Added smoothing to the bubbles so that they look better at lower resolutions of the model. This will help those with slower computers that have to run in lower model resolutions. Even 32 and 64 look pretty good now.
- Completely redesigned the configuration pane so that it correctly fits on an iBook screen (I never realized they were so small!) and is better organized (hopefully).
- Added **reflection mapping** to the colormap render style. This looks really good and increases the perceived resolution of the entire render.
- Added a **3D effect** to the colormap render style so that it looks bumped up.
- Added new **Contour Fill** render style.
- Added new **Contour Lines** render style.
- Added new **StreakLines** render style.
- Added new **Particle** render style.
- New background type added: **Desktop Background**. This uses the user's current desktop background for the background of Fluid. If the user has their "Desktop" settings set to change backgrounds automatically, Fluid will notice the change when it cycles. So, if you have your backgrounds set to change every minute and you have Fluid set to reset every minute, then Fluid will have a different background image each time it resets. Pretty cool. This setting is also very useful if you want to run Fluid all the time as your background. Now you can have Fluid just run with your background current background image and you don't have to change it in both places.
- New **Glass-Blocks** render "substyle" added for users with Radeon 8500 cards. This effect uses an OpenGL extension available only on that card, so it is not available to all users.
- Web-based backgrounds are now downloaded everytime Fluid resets. The background image is now also recaptured everytime Fluid resets.
- Added a new background warping effect called **Distort** . It displaces the pixels of the background image much like the Photoshop Liquify filter works, except Fluid does it in realtime around 40 frames per second on a decent machine and it is powered by the fluid model. This is basically the same effect that Alias/Wavefront is using for their Windows-only Maya screensaver. This is all that saver can do...this is but one of many effects that Fluid can do.
- Added a set of default Themes that are embedded in Fluid. This will allow us to have some themes without the user having to install them seperately. They will appear in the Themes menu under the **Default Themes** submenu.
- Fixed the corrupted background images that some people were seeing at certain resolutions. Woohoo!
- Fixed the bug in the colormap editor that caused the first color that was edited to change to full opacity in the Color Panel. Very annoying. Now it works correctly. My mistake.
- Changed colormaps in Colorgrade mode to always show the entire colormap spectrum available. Fluid now scales the colormap to match the available velocities. This way, you will always see the entire range of colors even if you set up a lame fluid model that would otherwise be very boring to watch.
- Random themes now correctly find all themes, not just those at the top level of the directory structure.

- Colormap menu is now disabled if there are no colormaps available. The randomize colormap button is also disabled for the same reason.
- Computer specific preferences are no longer saved in theme files. These include Multiproc, the Fluid model (Altivec or FFTW), and whether or not Fluid is rendered to the main screen only. Usually, you will only want to set these once and you want them to stay the same even if somebody else gives you a Theme of theirs and they have different settings on their machine.
- Fixed a very obscure crash that happened only when using randomize themes and the previous & current themes have certain flags turned on. This one was hard to track down.
- Now the name of the current theme is displayed at the bottom left of the screen for a couple of seconds when using randomized themes. This allows the user to identify themes that he/she likes.
- The Prefs window now loads backgrounds in the background so it shouldn't freeze while it is doing it any more. The way that backgrounds are handled internally is now much cleaner also so it should make dealing with backgrounds a little snappier.
- New About Box to reflect the changes in our new company identity change. About box is now much more simple. No scrollie box, no paypal logo, etc., etc. Just the logo, credits (obligatory), and a button bar. The Apple Way.
- Fluid now supports networked themes via Rendezvous! Fluid can now use themes found on other computers on the local network. Fluid Theme Server will allow you to serve your themes to the rest of the network. Fluid finds all Fluid Theme Servers automatically and their themes show up in your themes menu. How's that for "zero-config" networking? In addition, if you use random themes, then it will also use any network themes available. This option, available only when running Jaguar or later, can be disabled in the "Expert" tab of the Fluid config sheet. FTS is a stand-alone application which will eventually be a faceless app. While in development it will continue to be a standard OS X app that is present in the Dock. This is for development purposes only.
- Wrote a preference pane "application" for the Fluid Theme Server. Now you have a control panel to start/stop the server.

#### 1.1

- Fixed the white flash that appears at the start of the screensaver on some graphics cards.
- Added an option to render only on the main screen. This should solve many people's speed problems when multiple monitors/video cards are attached.
- Added an option to allow the user to set the fade-in / fade-out duration when Fluid starts or resets.
- Added plenty of help for controls via ToolTips. The ToolTips now explain what controls do in more detail.
- Moved some of the controls around to make the interface a little more organized and keep new users from changing some settings accidentally, even if they don't know what they do. The "expert" tab now contains all those types of advanced options.
- Fluid now has swappable global Theme files! Now you can swap your complete settings files with friends...not just your color map files! Themes also allow you to have multiple settings stored on your machine if you like to change some settings but don't want to lose that cool setting you've been running. They are basically Fluid save files.

#### 1.0.1

- Fixed bug where Fluid failed to look in system library folders for color maps. Was only looking in user's library folder.
- Fixed crash if user input a resolution lower than the minimum set for the formatter (8).

#### 1.0

- Initial public release!

#### 1.0wwdc

- Preview release to demo the CHColorMapControl for the WWDC WO/Cocoa BOF.



For more information visit the Fluid website:  
<http://www.concepthouse.com/products/Fluid/>

Check out our other products while you are there.

Send bug reports, comments, and kudos to [info@concepthouse.com](mailto:info@concepthouse.com)  
or to me personally: [chris@concepthouse.com](mailto:chris@concepthouse.com)

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