

MEGAFLOW

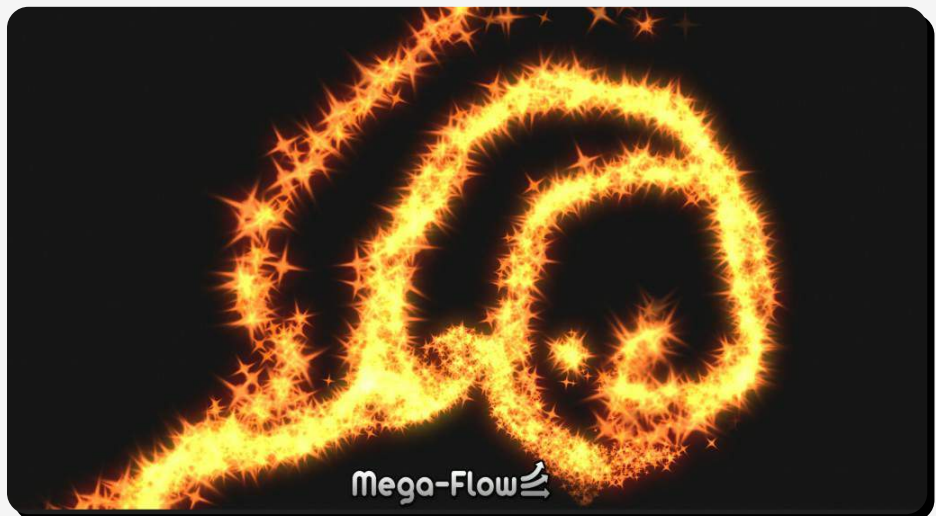


Overview of MegaFlow

Have you ever wanted to simulate a wind tunnel in your game, or have leaves of snow blow through your village flowing naturally around buildings, speeding up down alley ways or settling slowly in the lee of an obstacle, Lava flowing down a volcano side or Waterfalls cascading over rocks, Or a car stirring up leaves as it drives along a road in Autumn, vortices for your plane wings, perhaps an object floating along fast moving water, tornadoes, or even simulate gravity around objects in space, if so then MegaFlow can help.

MegaFlow is a set of systems that allow you to use Vector Fields to control the movement of objects or particle systems in Unity. Vector fields are a 2D or 3D grids of values that describe the direction and magnitude of velocities for that point in space. The Vector Field can be generated by systems such as Maya Fluids, FumeFX, Krakatoa, RealFlow etc. MegaFlow can import the files generated by those systems in the form of .FXD or .FXA files, it also has an exporter for Maya that will export any Maya fluid simulation to the MegaFlow .FLW format. You can then import a single frame or multiple frames into the MegaFlow system in Unity and then use that to control the movement of particles from either the Shuriken or Legacy particle system, or control movement of Rigid Bodies or just general objects. Don't worry though if you don't have access to any Fluid Simulation software as MegaFlow also comes with a system that allows you to author your own Vector Fields inside Unity using multiple splines to define flow directions and forces.

The movement of objects interacting with the Vector Fields is via a simple physics simulation which has parameters that allow you to control the overall force the field applies and the mass of the objects that are interacting with it, this means you can adjust the look and feel of the flow from either a very tight following of the flow to a subtle influencing only of objects that move through the field. You can change the force the field exerts or reverse the flow direction. All the values can be adjusted at runtime via script of the Unity animation system if required. The physics code used is optimized for performance and makes use of multi threading on any system that has multiple cores for super fast performance even with 10's of thousands of particles being moved.



If a system such as FumeFX or Maya fluids has been used to create the Vector Fields then that would allow you to place obstacles into the flow, if the flow is then used to control a Particle system you can get even more performance back by disabling the collision system in the Particle system, since the Vector Field will now handle moving the particles around objects in the way, this can get you quite a saving in CPU time in complex scenes. You can off course still use the collision system of the particles or rigid bodies alongside the flow system if you wish.

The Vector Field source can have any number of Vector Fields loaded so you can do animation of flows if required, or just easily swap the flow field being used to change the look and flow of your scene. You can ask the system to show you the flow through the system of objects via the visualization options, or display the flow as either vector

lines or colored cells.



Included in MegaFlow are various components to help you use the Vector Fields in your projects. There are components to control the Unity particle systems as well as a component you can attach to any rigid body object that will then allow that object to be influenced by the Vector Field. There is also an example Smoke Gun script that will inject large numbers of objects into a scene so you can see how they flow.

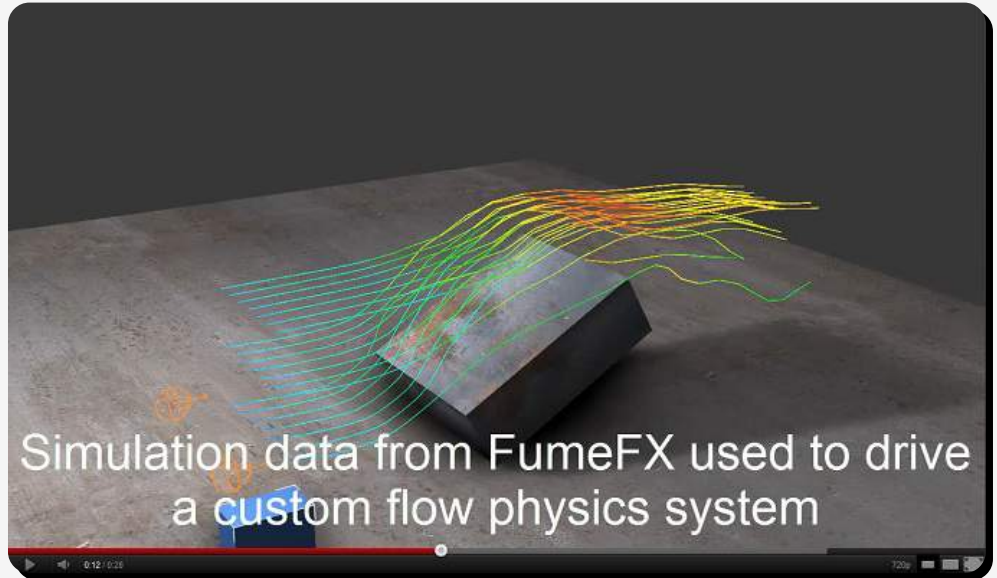
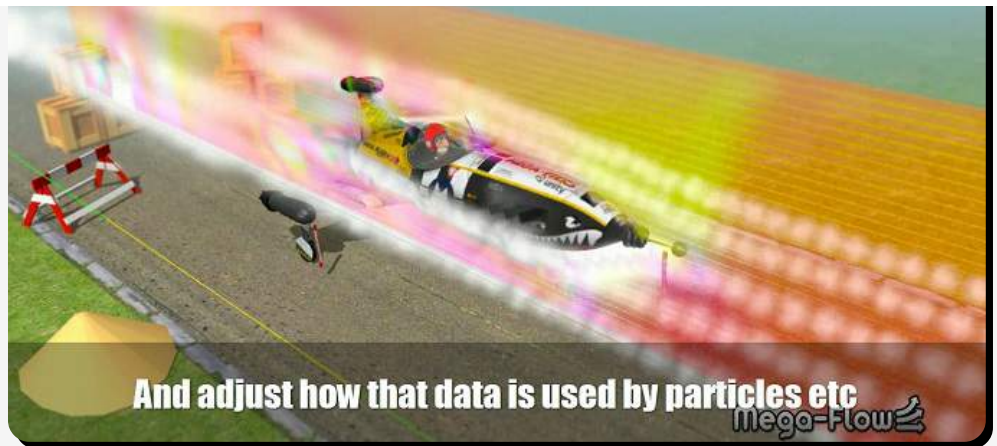
Features

- Support for FumeFX FXD file import
- Support for FGA file import
- Custom Maya Fluids Exporter
- Create Vector Fields in Unity
- Multi-Threaded physics
- Highly optimized physics code
- Source Code Included
- Multiple frames of flow data per source
- Control Legacy or Shuriken particles
- Control Rigid Bodies
- Control Normal Objects
- Works in Unity Free
- Works on Mobile devices
- Flow visualization
- Create a 3d Texture from the flow
- MegaShapes Lite included

Video Examples

Below are a couple of videos showing the MegaFlow system being used in a couple of scenarios, the first uses a Maya Fluid simulation to simulate the airflow around objects in a scene, the second shows the in Unity creation of Vector Fields from splines and that then being used to control a particle system.





MEGAFLOW SOURCE



MegaFlow Source

The MegaFlowSource component is the core of the MegaFlow system, this is where you can import and visualize your flow data. You can import various file formats and currently MegaFlow supports .FGA, .FXD and .FLW files. FGA files are used by the Unreal Engine for controlling its particle system and you can find on the internet various plugins for packages such as Maya and 3ds Max for exporting fluid data to FGA files. FXD files are generated by FumeFX with other Fluid Simulation packages also supporting the format. FLW files are a custom human readable format for MegaFlow and we have a custom exporter for the Maya package to allow you to export the Fluid Simulation data to FLW files.

Once a fluid source has been created you can freely move, rotate or translate that object in your scene for more fun effects, for example attach one to the back of a plane object as it flies through smoke particles and see the smoke react with flow over the plane, or if you have flow in the shape of a tornado you can rotate, move and scale that flow and adjust the force scale to add more variety or menace to that tornado in your scene.

Adding a Flow Source to your Scene

To add a Flow Source to your scene just go to the GameObject/Create Other menu and select the MegaFlow section then click the Source option. This will create an object in your game called 'MegaFlow Source'. Once added you will see the inspector params that are described below. Next you will need to import some flow data. First select the Data Source type in the drop-down. You can choose either FumeFX, MegaFlow or FGA. You can either import a single frame of data or a sequence of frames if you want to have a complex animated flow. If you select Sequence you can then set the First and Last frame from a sequence to load as well as setting a Frame Step value, this allows you to skip frames from the sequence when importing the data. Since fluid sims are quite well fluid you can usually get away with having large steps in your animation sequence, so it is a trade off between memory and accuracy. Next click the Load button, if loading a sequence you only need to pick any file from the sequence and MegaFlow will compute the correct names for the files to be loaded from that, if you are loading a single frame then pick the actual file you wish to import. A progress bar will show the progress of the import. You can cancel the import process if required.

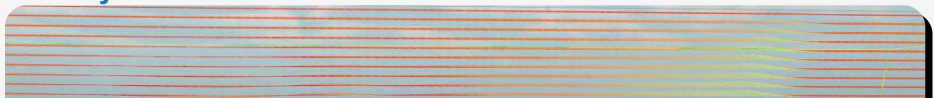
Fluid Data Visualization

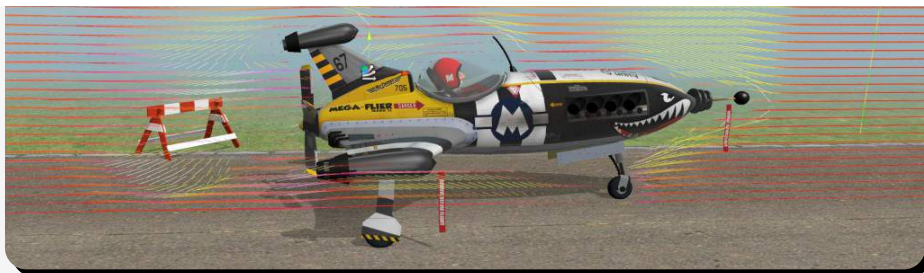
Once some data has been loaded you can then pick from the various options for displaying the data, you can choose to display the data either as vector lines, or colored cells, or a set of ribbons to show the flow of objects through the data. If you have multiple frames of data loaded you can change the one being displayed by changing the 'Frame' slider. Also the inspector will display the current memory usage of all the data currently loaded. The Clear All frames button will delete all the fluid data loaded to the source, or you can delete the current working frame using the 'Delete Frame' button.

Ribbons Option Showing the Flow Movement



Velocity Vectors





Velocity Cells and Vectors



Once you have your data loaded you can then use that to control objects in your scene, please look at the other pages for how to use the Flow Source to control your particle system, rigid bodies or general objects.

Param Guide

Below is a breakdown of each section of the MegaFlow Source inspector with an explanation for every param.

Main Params

These are the main import params for the source as well as the fold outs for the data visualization options for the fluid data.

Optimize Frame Data

Since Fluid data is usually a 3D grid of values it can sometimes take up a large amount of memory. MegaFlow allows you to optimize the size of the data to reduce it by 66% at the cost of a tiny bit of accuracy and slightly slower physics updates for objects using that frame data. If you think a frame of data could benefit from being optimized then make sure you have the frame you want selected via the Frame slider, then click this button. Once a frame is optimized it cant be undone, and if you need to revert then you will need to import the data again.

Clear All Frames

Clicking this button will delete all Fluid Data from the source.

Data Source

You can select the type of Fluid Data to import here. You can choose from FumeFX (.fxd files), MegaFlow (.flow files) or FGA files.

Sequence

You can choose to load either a single frame or a sequence of files. If you want to load a sequence then select this option. When loading a sequence MegaFlow will derive the names of the files from the one you select when you click the load button, replacing the frame number in the filename, so you only need to select any file from the sequence when asked to select a file.

First Frame

When importing a sequence you can set the first frame to load here.

Last Frame

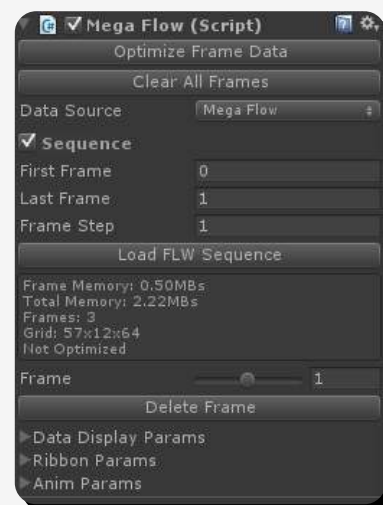
When importing a sequence you can set the last frame to load here.

Frame Step

Usually you dont want to import every frame of a fluid simulation sequence, so you can ask MegaFlow to skip frames, so if you have a sequence that is 100 frames long but only want 4 frames, set the first frame to 0, last frame to 100 and frame step to 25, then MegaFlow will only import frame 0, 25, 50 and 75

Load Button

Click this button to load your file or sequence, you will be presented with a file select window, for a single frame import select the actual file you want to import, for a sequence you only need to select any frame from the sequence



sequence.

Info Panel

This panel gives a breakdown on the current number of frames imported, the total memory use and the current frame memory use, it will also say if the frame data is optimized or not.

Frame

If you have more than frame of data imported the Frame slider will appear, this allows you to select which frame of data should be visualized.

Delete Frame

Click this button to Delete the current frame of data.

Data Display Params

Click to open the main data display options. See below.

Ribbon Params

Click this to open the Ribbon display params. See below.

Anim Params

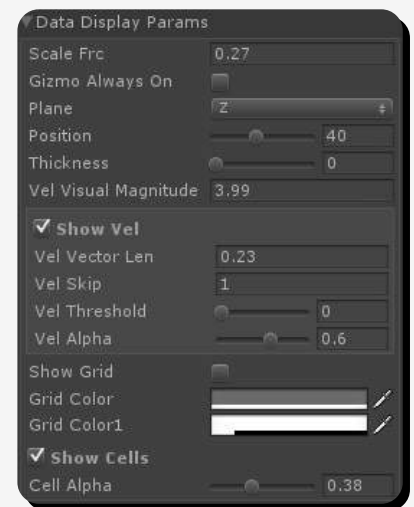
Click this to open the Anim params. See below.

Display Params

This section has the main data visualization options.

Scale Frc

This allows you to scale the force of Vector field values, this will alter the coloring of the vector and cells, and alters the flow of the ribbon simulation. It will also effect any system using this fluid source to control objects, soV



Grid Color1

The second color used for the grid.

Show Cells

Check this to show the velocities as colored cells, this only works for users of Unity Pro.

Cell Alpha

How see through the cells are.

Ribbon Params

MegaFlow allows you to send ribbons into the flow data to visualize how an object or a particle will react to the flow. Each ribbon will render a coloured trail so you can see how it will react, you can alter the physics params used to control the flow of the ribbon as well as how many ribbons are sent and the size of the area they are sent from. When enabled you will see an extra position handle appear in the scene which you can use to move the ribbon source around, you can also scale the ribbon source in the scene by clicking and dragging the small squares on the edge.

Show Ribbons

Turn on the display and calculation of the ribbons. Depending on the settings below the ribbon display can be quite slow.

Ribbon Pos

The start position for the ribbons in the flow. You can also change this by dragging the position handle in the scene view.

Dt

The time step to be used by the physics calculation.

Density

The density of the fluid the ribbons are flowing through.

Area

The surface area of the object being simulated, the larger the area the more influence the flow will have over the object.

Reynolds

The Reynolds number for the fluid, you probably wont need to change this.

Mass

The mass of the object being simulated, the lower the mass the more influence the fluid flow will have on the ribbon.

Floor

A floor value to stop ribbons.

LineStep

The distance between samples when drawing the ribbon paths, higher values means less lines are drawn and is faster.

Size Z

The size of the ribbon source in the Z direction.

Step Z

How many ribbons along the Z axis.

Size Y

The size of the ribbon source in the X direction.

Step Y

How many ribbons along the y axis.

Gravity

Gravity value to be used by the physics.

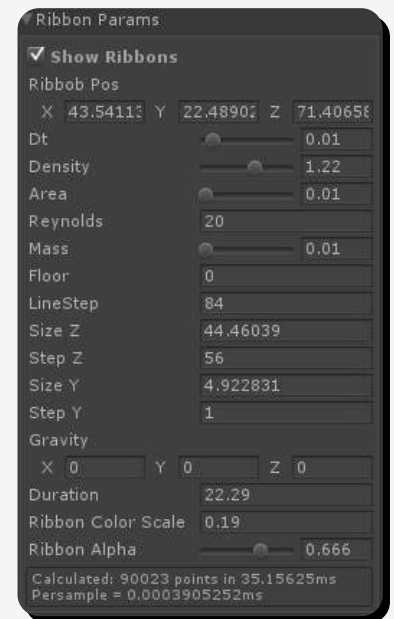
Duration

How long the object exists for the physics simulation, basically how long a trail is shown.

Ribbon Color Scale

Adjust the velocity value scaling when calculating the color. The color shows the velocity of the object at a point on the trail.

Ribbon Alpha



How see through the ribbons are.

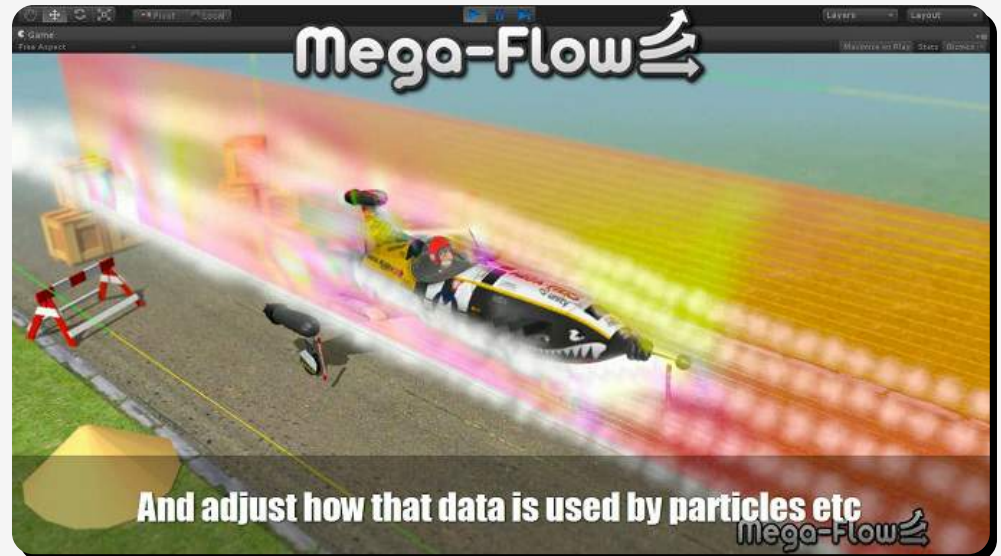
How see through the ribbons are.

Info Panel

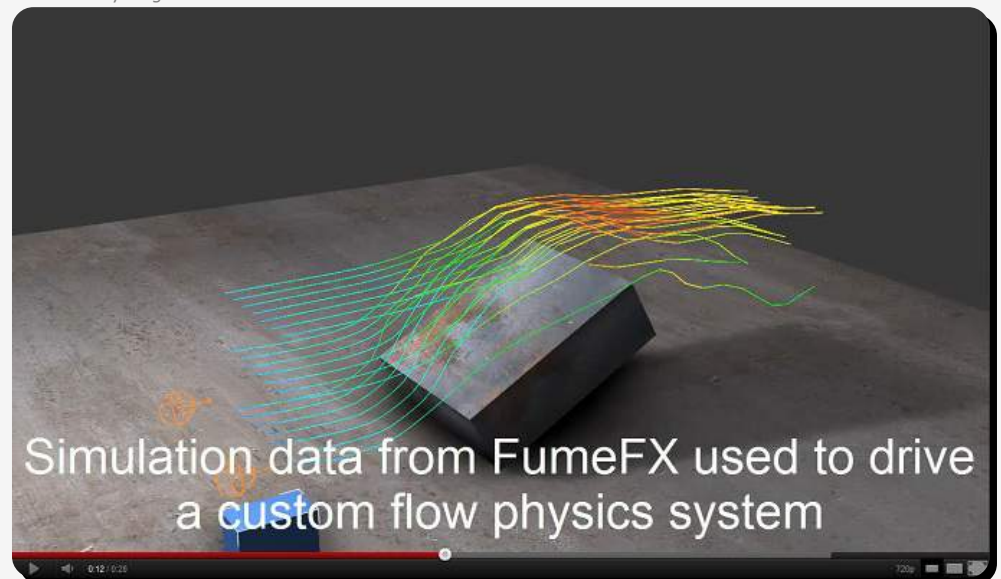
This panel gives a little info on how many physics calculations were done to compute the ribbons, how long that took, and the average time per physics step.

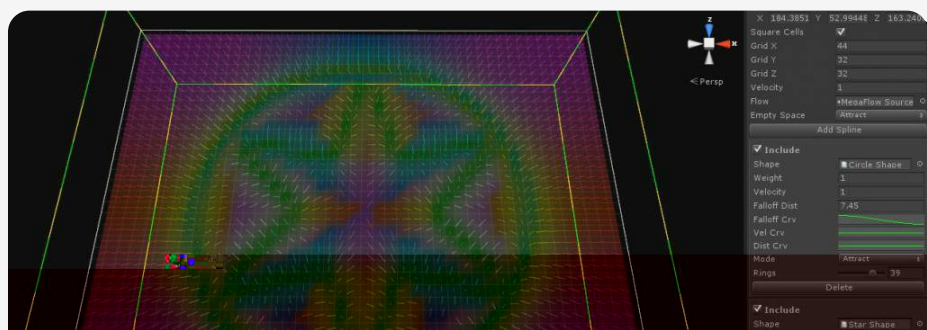
Videos

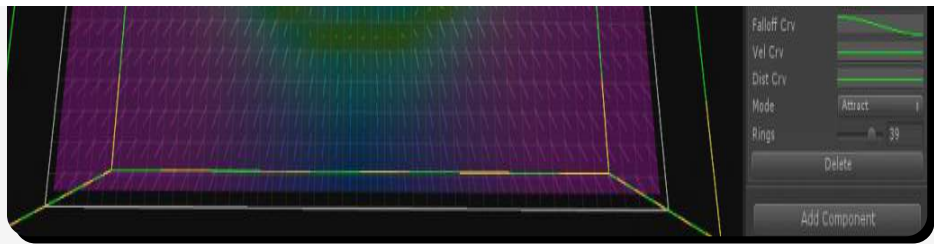
Video showing the output of a Maya Fluid Simulation exported via the MegaFlow exporter and used to control a particle system showing smoke flowing around the MegaFlier and other obstacles.



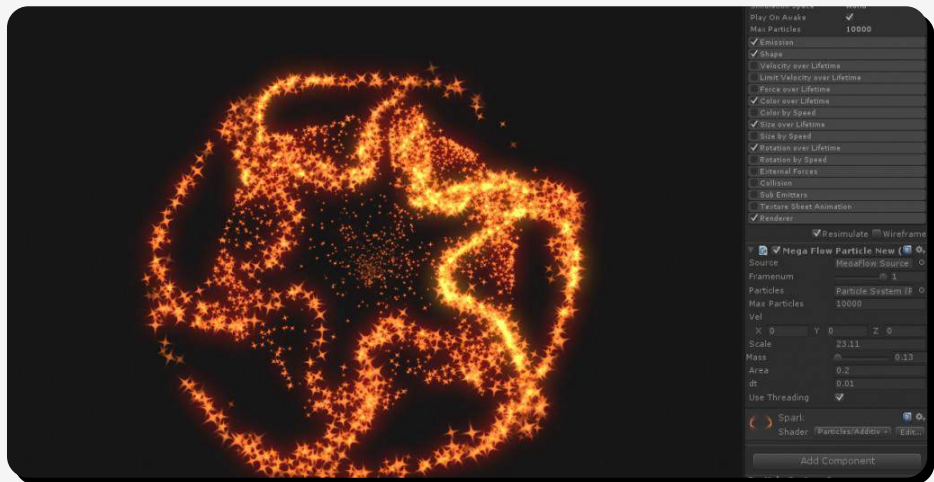
Another video showing a FumeFX simulation generated in 3ds Max and exported to FXD files used to control the movement of 1000's of objects. No collision detection or Rigid Body physics is used in the scene, all movement is controlled by MegaFlow.







Once you have that done you are ready to create the flow field. Make sure you have the MegaFlow source you want to add the final flow field to selected in the Flow section of the inspector and then click the 'Create Flow' button, a progress bar will appear showing the progress of the flow creation, depending on how many splines you have in your field and the number of cells in the field this can take a few seconds. Once completed the flow field will have been added as a new frame to the flow source, so if you now select the flow source and change the Frame slider you will see the final flow field, you can now test that out to control your particle system or other objects.



MegaShapes Lite

We have included a lite version of our MegaShapes system with MegaFlow to allow you to build the splines. MegaShapes is an advanced Bezier Spline solution for Unity allowing for any number of splines to be created and even animated and we have exporters available for Max and Maya to allow you to edit your splines in those 3d packages and then import them into MegaShapes. The lite version of MegaShapes also comes with components to attach objects to splines and move them along as well as various options to turn the splines into meshes, either by filling in the shapes or extruding along their length to make pipes, tubes, ribbons etc.

MegaFlow Create From Splines Params

Once you have your options set you can generate the flow field by clicking this button, the resulting flow field will be added as a new frame the selected MegaFlow source set in the Flow param below.

Size

The overall size of the flow field, you can also use the boxes on the side of the bounding gizmo to adjust the size of the flow field.

Square Cells

Check this box to tell the system to keep the flow cells square.

Grid X

The number of flow cells to use along the x axis.

Grid Y

The number of flow cells to use along the y axis.

Grid Z

The number of flow cells to use along the z axis.

Velocity

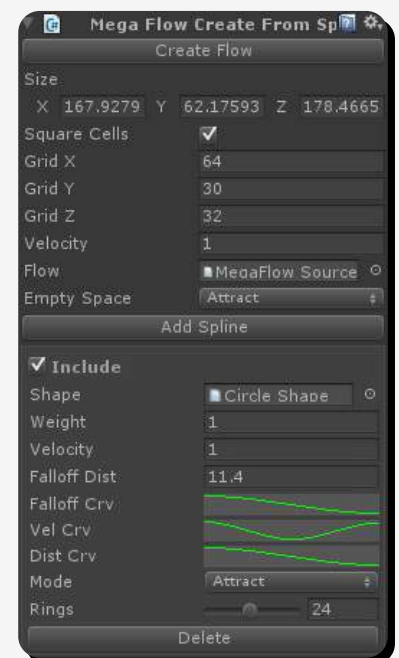
The global velocity value for the flow field, each splines velocity value will be multiplied by this, this makes it easy to adjust the whole flow fields velocity.

Flow

The MegaFlow source the flow field will be added to when it is created.

Empty Space

Which happens is any cell that has no influence from any spline you can set whether the flow should be towards



what happens in any cell that has no influence from any spline, you can say whether the flow should be towards the nearest spline, away from or flow along the spline. Attract usually works best in most cases.

Add Spline

Click this to add a new spline to the list.

Include

This allows you to quickly removed a spline from the final calculation.

Shape

The MegaShape spline to use . If the shape has multiple splines attached then all the splines will used.

Weight

How much this spline will contribute to the end result.

Velocity

The velocity of the flow along this spline.

Falloff Dist

The max distance from the spline to be effected by the flow.

Falloff Crv

The curve that defines how the velocity changes over the fall off distance.

Vel Crv

This curve changes the velocity value along the length of the spline, this allows you to have fast and slow sections on the same spline.

Dist Crv

This curve changes the fall off distance along the length of the spline.

Mode

What kind of flow the spline causes, either attract, repulse or flow. Attract will move objects in towards the spline line, repulse will push objects away, flow will make things move in the direction of the spline.

Rings

This changes how many rings are used to show the area of effect of the spline.

Delete

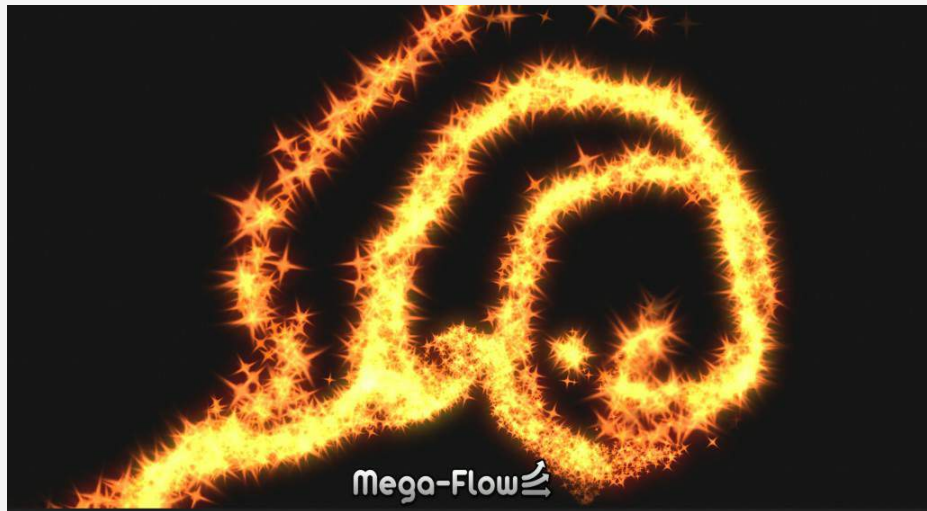
Delete the spline from the list.

Video

This video shows the Create Flow from spline system being used to create a flow field which is then used to control a particle system.



MEGAFLW PARTICLE



MegaFlow Particle Controller

This component allows you to control any Unity Shuriken Particle system with a MegaFlow source. Particles will be influenced by the flow if they are inside the bounding box of the selected flow source, if not inside they will continue moving as if controlled by the particle system. The amount the flow field influences the particles can be controlled by various physics params such as mass and area, and you can select any frame of data from the flow source to be used and adjust the overall force applied by that field.

You can also make use of the normal Unity transform functions to move the flow source, or rotate or even scale it to add more control to you particles if you need to, so for example you could attach the flow source to a game object so as it moves through a scene it will disturb particles or anything else controlled by that source.

The physics system used to control the particles has been fully optimized to allow you to control 1000's of particles if you want, and on devices with multiple cores you can enable the Multi threaded option for even more performance. If you are using the Legacy particle system then there is a Legacy version of this component that woks just the same but for Legacy particle systems.

This is a basic example of interacting with a flow source, if you have any ideas of suggestions for more options or controls then please do let us know and we will get them added in.

How to use

To use the MegaFlow Particle controller you just need to add this component to any object in your scene, once added select the flow source you want to use to control the particles, and then select the particle system you want to control. That is all, now it is just a case of tweaking the settings to get the look you want. Also set the Max Particles value to the maximum particles you think the particle will use to make sure the system will control all the particles that might be emitted, usually best to set it to the same value as the Max Particles setting on the particle system.

This section describes the various params used to control the particle interaction with the flow source.

Source

Select the MegaFlow Source you want to control the particles with here.

Framenum

If the flow source has multiple frames of data loaded then this slider will appear so you can select the frame to use.

Particles

The particle system you want to control with this.

Max Particles

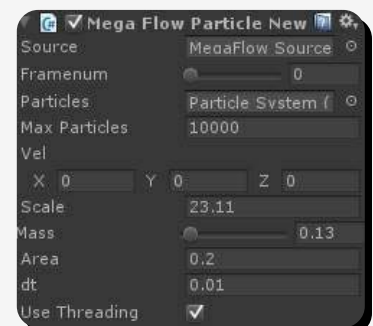
The max number of particles the system will control, set this to the same value as the particle system you are controlling.

Vel

Currently unused.

Scale

You can control the overall max force applied by the flow source, this allows you to make you particles move faster, slower or even backwards.



Mass

The mass of the particles being moved, the lower this value the tighter the particles will follow the flow, a value of 0.01 will mean the particles will follow the flow exactly, as the value is increased the particles will be influenced less by the flow so not sticking to the flow direction.

Area

The effective surface area of the particles, increasing this will mean the flow source will have more influence over the particle movement, use along with the mass value to adjust the flow.

dt

The time step used by the physics system. The lower the value the more CPU time the system will use.

Use Threading

If your build target has support for multiple cores then this check box will appear this allows you to enable the multi threaded physics option for more performance.

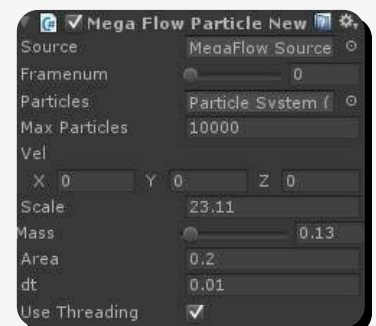
Video Showing use of MegaFlow Particle

MEGAFLOW PARTICLE LEGACY



MegaFlow Particle Controller

This component allows you to control any Unity Legacy Particle system with a MegaFlow source. Particles will be influenced by the flow if they are inside the bounding box of the selected flow source, if not inside they will continue moving as if controlled by the particle system. The amount the t



Mass

The mass of the particles being moved, the lower this value the tighter the particles will follow the flow, a value of 0.01 will mean the particles will follow the flow exactly, as the value is increased the particles will be influenced less by the flow so not sticking to the flow direction.

Area

The effective surface area of the particles, increasing this will mean the flow source will have more influence over the particle movement, use along with the mass value to adjust the flow.

dt

The time step used by the physics system. The lower the value the more CPU time the system will use.

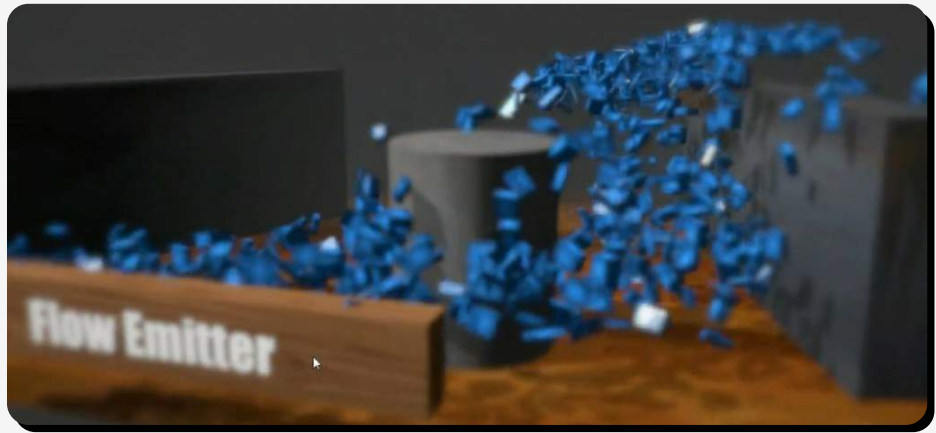
Use Threading

If your build target has support for multiple cores then this check box will appear this allows you to enable the multi threaded physics option for more performance.

Video Showing use of MegaFlow Particle

Not done yet

MEGAFLOW RIGID BODY



MegaFlow Rigid Body

As well as controlling particle systems MegaFlow can be used to control the movement of Rigid Body objects as well. The flow will be used to apply forces to the rbodies and you can control the amount of influence the flow has on the object.

To use this all you need to do is add the component to any rigid body object you want to control, then select the flow source to use and set the physics values, then when your scene is run if the object moves into an area of the MegaFlow source then forces from that flow source will be applied to the object, you can adjust how much influence the flow has by changing the scale and area values. There is no mass value in this component since the mass of the rigid body will be used. This component does not actually directly move the rigid bodies but just applies a force based on the flow field, so the object can still be controlled by other controllers and collide with other objects etc.

This is simple script which we pain to extend and add to ass we get feedback from users, so if you have any suggestions or features you would like added please do let us know.

MegaFlow Rigid Body Params

This describes the various params used by this component.

Source

The flow source to use to control this object.

FrameNum

If the flow source has multiple frames you can select the frame to use by changing this value.

Scale

Adjust the force the flow field applies to the object, you can change this to speed up or slow down objects or make them move backwards.

Reynolds

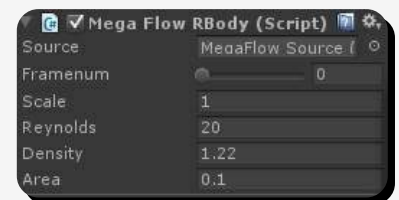
Reynolds number for the flow.

Density

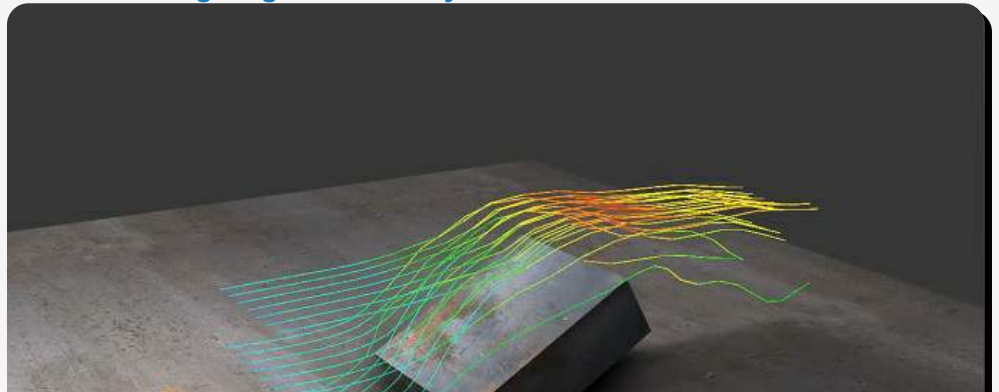
The density of the flow source.

Area

The surface area for the object, controls how influenced the object is by the flow around it.



Video Showing MegaFlow RBody



Simulation data from FumeFX used to drive
a custom flow physics system



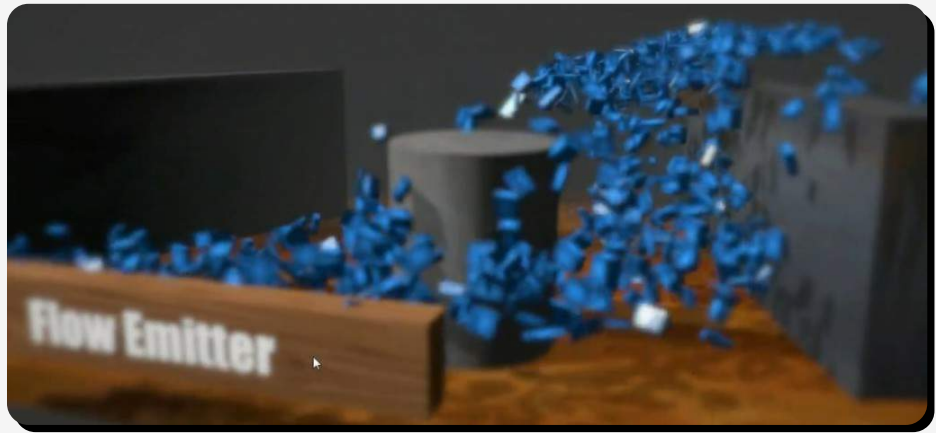
0:12 / 0:16



720p



MEGAFLOW EFFECT



MegaFlow Effect

As well as controlling particle systems MegaFlow can be used to control the movement of any game objects as well. The flow will be used to move the objects with a custom physics system and you can control the amount of influence the flow has on the object.

To use this all you need to do is add the component to any gameobject you want to control, then select the flow source to use and set the physics values, then when your scene is run if the object moves into an area of the MegaFlow source then forces from that flow source will be applied to the object, you can adjust how much influence the flow has by changing the scale and area values. There is no mass value in this component since the mass of the rigid body will be used. This component does not actually directly move the rigid bodies but just applies a force based on the flow field, so the object can still be controlled by other controllers and collide with other objects etc.

This is simple script which we pain to extend and add to ass we get feedback from users, so if you have any suggestions or features you would like added please do let us know.

MegaFlow Effect Params

This describes the various params used by this component.

Source

The flow source to use to control this object.

FrameNum

If the flow source has multiple frames you can select the frame to use by changing this value.

Scale

Adjust the force the flow field applies to the object, you can change this to speed up or slow down objects or make them move backwards.

Reynolds

Reynolds number for the flow.

Density

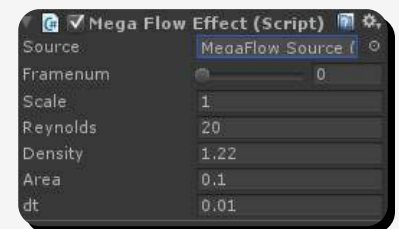
The density of the flow source.

Area

The surface area for the object, controls how influenced the object is by the flow around it.

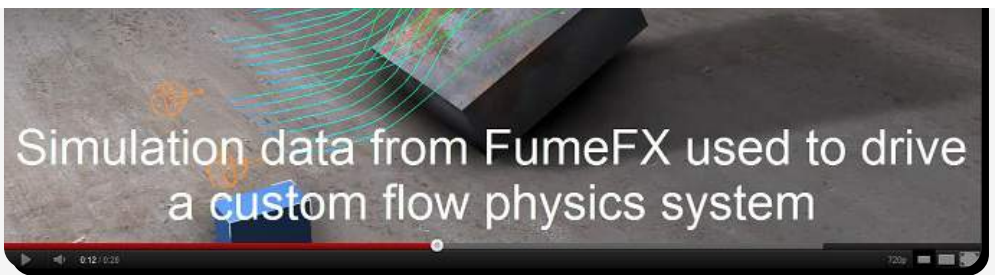
dt

The time step to use by the physics system to control the object.

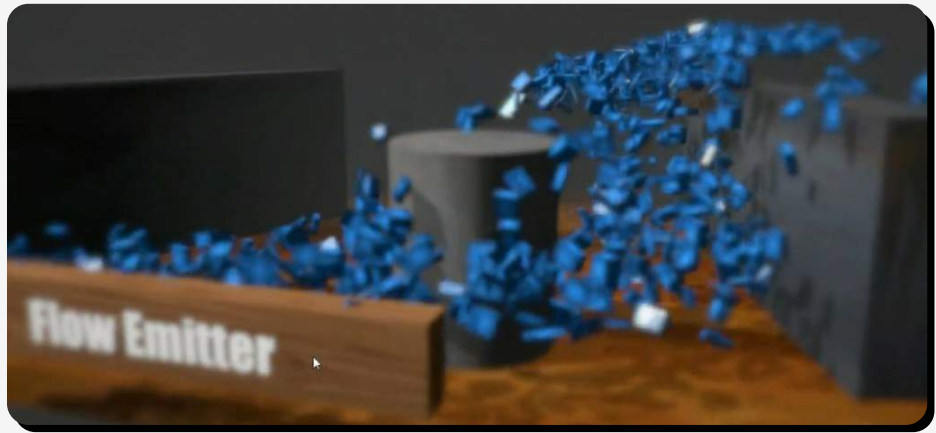


Video Showing MegaFlow Effect





MEGAFLOW SMOKEGUN



The smoke gun component is a simple example script. It simply spawns set objects into the scene but if those objects have a MegaFlow component attached then they will interact with the selected MegaFlow source and be moved around the scene. This is a simple way to test a flow source with set objects. The physics values for this component will be applied to each object spawned into the scene so you can quickly adjust the settings and see the result. You can select multiple objects to be spawned and those objects could have either the MegaFlow RBody component attached or the MegaFlow Effect component. If you select an object which does not have either of those components attached then the object will just be spawned into the scene and not move.

This script also allows the emitter object to be controlled by a mouse, when the scene is run holding down the left mouse button and moving the mouse will move the emitter, you can adjust the mouse sensitivity by changing the x and y speed values in the inspector.

MegaFlow Smoke Gun Params

The following params control the behaviour of the object spawning and the movement of those objects through the flow.

The MegaFlow source to use to control the flow of the spawned objects.

If the flow source has multiple frames for fluid data then you can select the frame to use here. Changing this value at runtime will only effect newly spawned objects, existing objects will continue to use the frame they were spawned with until their life runs out.

The time gap between spawning objects, the lower the value the faster objects will be spawned.

How many object will be spawned each time.

The starting velocity of the new objects.

A multiplier for the effective force of the flow field on the objects.

The mass of each object spawned. The lower this value the more effect the flow field will have on the movement of the object.

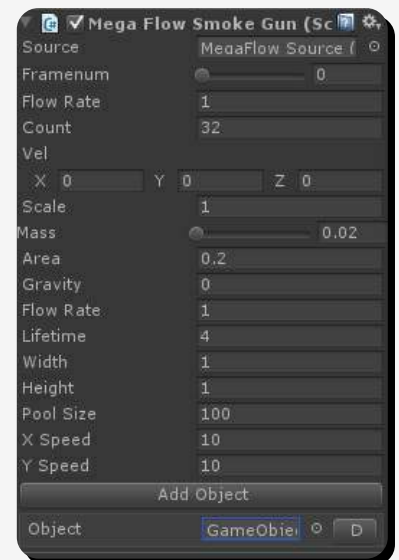
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The area value for the objects spawned, the larger this value the greater the influence of the flow field on the objects movement.

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Thl bl y s i t

Gravity value to use in the pht phw



The height of the emitter. Objects are spawned randomly within the limits of the width and height values.

The starting pool size for objects to use by this component.

The sensitivity of the mouse movement in the x direction.

The sensitivity of the mouse movement in the y direction.

A

Click this button to add a new object to the spawn list.

Selects the object to be spawned. This object should have either a MegaFlow Effect or MegaFlow RBody component attached to it. Click the D button to remove an object from the list.

MegaFlow Smoke Gun Video

Video showing the Smoke Gun system spawning cube objects into the scene.

