



**ARIVE**

augmented reality interactive visualization engine

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# ARive RC1 Manual

ARive is an easy to use Augmented Reality framework that is released as open source under the GPL license. This is the official manual for Release Candidate 1, May 19<sup>th</sup> 2008

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<http://www.formbureauet.com>

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# ARIVE

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augmented reality interactive visualization engine

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ARive: Augmented Reality Interactive Visualization Engine

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ARive is based and built from many things; my own code in Flash for the GUI; sourcecode available shortly

on ARive's webpage: <http://formbureauet.com/wordpress/arive/>

The .exe itself is dependent on libraries from HITLabNZ as supplied in ARToolKit and osgART Standard Edition, as well as OpenSceneGraph. All rights are reserved to those to whom they belong.

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## What is ARive?

ARive is a small application for displaying digital 3D-models on a physical marker, as recorded by a webcam.

ARive is a simple application based on [ARtoolkit](#), [OpenSceneGraph](#) and [osgART](#), and will be released as open source. -Allowing anyone with a webcam and some 3D-modelling skills to start playing immediately with what has previously been described as play and explore what AR can do, with high quality rendering and performance.

I am trying to create an application that will make it easy for designers, artists and architects to create AR-projects without any prior knowledge or high technical insight.

## What it does:

It captures video, and when the camera registers a “marker”, it places a 3D model on it in realtime. -The model can be animated, textured, interactive and more.

This is not new, however there are few or no existing graphical user interfaces (GUI's) that makes this easy for laymen to set up.



### Screenshot:

A digital 3D model of a torus-knot placed on a physical marker glued to a cardboard box.



## What is Augmented Reality

Augmented Reality is a term coined by Tom Caudell in 1990, describing the augmentation of physical reality by blending it with virtual (digital) content.

Ronald Azuma's definition of AR is one of the more focused descriptions. It covers a subset of AR's original goal, but it has come to be understood as representing the whole domain of AR: Augmented reality is an environment that includes both [virtual reality](#) and real-world elements. For instance, an AR user might wear translucent goggles; through these, he could see the real world, as well as computer-generated images projected on top of that world. Azuma defines an augmented reality system as one that

- combines real and virtual,
- is interactive in [real-time](#),
- is registered in three dimensions.



## System Requirements

ARive is not widely tested at this moment, system requirements are general guidelines:

- OS: Windows 98/XP/2000/Vista
- CPU: Min. 1000Mhz Intel/AMD
- RAM: Min 512MB
- Graphics card: DirectX-compatible with min. 128MB RAM
- HD-space: Installation will require ~30MB depending on what is supplied with the release.
- CAM: A normal DirectX-compatible webcam, supporting either the RGB 24 or I420 video standards (most do)
- ARive is also compatible with Point Grey Dragonfly-cameras using the optional DirectShow drivers.
- Printer: A B/W printer to create markers, or print out the supplied standard marker.



## Getting Started

### Installation

1. Download ARive for free from: <http://www.formbureauet.com>
2. Unzip the installation folder to your hard drive.
3. Double-click the setup.exe-file.
4. Follow the on-screen instructions.



### Uninstalling ARive:

Simply click the “Uninstall ARive RC1” icon located in your start-menu.

- All drivers, \*.dll-files, and additional files installed are all located in the ARive-folder,  
so uninstalling using this option will delete all files copied to your hard drive during the initial installation.



## Printing the marker

To use ARive, you need two things:

1. A digital 3D-model (a test-model comes supplied and pre-installed)
2. A physical “marker”.

## What is a marker?

A marker is simply a physical piece of graphics that ARive can recognize through your webcam.

When a marker is detected, ARive calculates its relative size, position and rotation relative to your camera, and places your 3D-model on it, properly scaled and rotated to make it look as if it is physically there.

ARive uses what is called a “fiducial” marker system; the markers are defined as black squares, easily recognizable by a webcam.

The corners of the square are used to calculate the markers position; the graphics in the middle (could be anything, the supplied marker is an “A”) are used to identify which way the marker is pointing, and also to differentiate it from other markers, if many are used.



### The supplied marker

A pre-configured marker is included in your installation, that will work with both the test-model, and your own projects.

It is a JPG-image Located in the default installation directory:

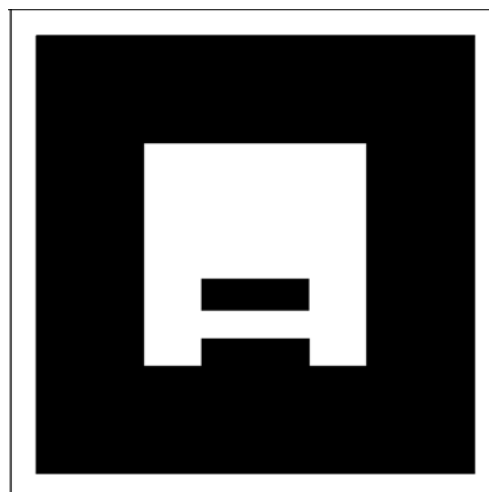
“C:\Program Files\ARive RC1\pattern sample\”

Simply print it at 100% scale, and ideally glue it to a flat surface.

- Note:

1. Markers should not be glossy, it could make the marker difficult to see for your camera.
2. ARive will work if you print the marker in another scale than supplied, however your models will be proportionally affected by this as well;  
i.e. if the marker is 50% of the original scale, the model will be half its size as well when rendered to your screen.

You can create your own markers, with your own inner pattern-image, and your own scale. See the Advanced Features-section for more on this.



ARive's default  
marker



## Testing ARive

Once you have printed your marker, you are ready to test ARive.

1. Start the program
2. Enter the **library** by clicking **[L]**
3. Check the radio button next to the ARive.ive-model, to set it as your active model, and click OK
4. Enter **options** by clicking **[O]**
5. Here you can set the scale of the model in percentage, or tell ARive if it should be displaced in relation to the marker;
6. **Run** the engine by clicking **[R]**
7. Depending on your webcam-driver you will have to set the resolution of your video. Normally, with microsofts DirectShow-drivers it will look like this
8. Set resolution **[1]** and framerate **[2]**, then click **OK**.<sup>1</sup>
9. A viewer-window should open, with the live video feed from your camera.
10. Point the camera towards your marker, and the supplied 3D model should appear.

**If the model does not appear on the marker, try adjusting the brightness/exposure/contrast settings of your camera; ARive is a bit picky when it comes to this.**

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<sup>1</sup> If your resolution is set higher than your Windows desktop resolution, ARive might crash. If this happens, try setting it lower.



## Creating your own project

To create your own content and 3D models for Arive, you have two ways of doing it:

1. Converting an existing model to the \*.IVE or \*.OSG format through ARive's in-built converter<sup>2</sup>
2. Directly exporting a 3D-model from 3DStudio Max, using an export plugin.

The second procedure is recommended, as you have more control and will get smoother results, and support for more advanced geometry, modifiers, particle systems etc.

### 1. Using the in-built converter.

1. Start ARive
2. Open the **tools**-window by clicking **[T]** asd
3. Click on convert 3D-model
4. Navigate to your 3DS-file and click OK
5. Navigate to where you want to store your new model
6. Type in the file name, and remember to specify while typing whether to store it as an \*.ive or \*.osg file:

I.e, for a filename, type the extension as well: testmodel.ive

7. Click **OK**

### 2. Using the OsgExp-plugin for 3DStudio Max

1. Download and install the plugin from: <http://sourceforge.net/projects/osgmaxexp>
2. Create a new project in 3DStudio.
3. Set your Units to Millimeters – this will ensure that your model will be scaled properly and look the size you make it when you run ARive.
4. Create your work.
5. Click file->export in max, choose \*.ive OpenSceneGraph as file format.
6. Export your file.

More information and tutorials on OsgExp can be found on the link above.

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<sup>2</sup> This is a slightly modified version of osgconv, created by



## Some modeling tips

1. To get better looking models, try texture-baking a rendered scene to your materials.
2. To fake shadows cast by objects, create a shadow map on a plane beneath the object.
3. ARive does not light your models, you do this yourself by creating lights in MAX  
ARive currently supports OMNI and DIRECT lights.  
-Try to limit the amount of lights to keep a high framerate
4. To fake reflections, create a spherical reflection map for your material.
5. If an animation does not run when exported, try to add a SEQUENCER object to it from the osgExp-plugin.
6. ARive only supports standard-materials from MAX, so no Arch&Design or VRayMtls will work.  
-Try texture-baking fancy materials instead!



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## Adding your own project to ARive's library

You can store up to 10 projects at any given time in ARive's library, to easily gain access to them.

NOTE: At the current stage in development, ARive has a slight bug; after adding a model to the library, you have to close and restart ARive to make it work; else ARive will crash when you launch it.

1. Open the library by clicking [L]
2. Choose a slot to add your new model.
3. Click the [...] button next to the slot.
4. Navigate to the \*.ive or \*.osg file of your choice.
5. Click OK
6. Close the library by clicking OK
7. Restart ARive



## Advanced Features

These are some of ARive's advanced features. ARive is aimed at being intuitive and easy to use; these features are not necessarily so. -Some of them require a bit more technical proficiency.

### Creating your own marker

You can create your own marker if you like.

This entails two steps:

#### Creating the image

1. The simplest way of doing this is editing the supplied marker JPG in Photoshop or any other software, and replacing the A with any graphics you like. Complex colour-images will work, but simple black-and white patterns are easier for the software to recognize. <sup>3</sup>
2. Print your marker in the size you want it, optionally glue it to something flat.

#### Register the marker

1. Register the maker by opening the Tools window, and click **register new marker**
2. ARive will ask for your camera-calibration file; just click OK, or type in the path to an alternative path.
3. A viewer will open. Hold your new marker perpendicular to your camera, in good lighting conditions.
4. When ARive recognizes a marker, green and red edges will appear around the black square, indicating that you can register the marker.
5. Click inside the viewer window. – You will be asked to supply a name for your new pattern, i.e patt.mypattern
6. Either register more markers or close the window when done.

#### Tell ARive to use your marker instead of the default

1. Navigate to your ARive-install directory
2. Open the "data" subdirectory
3. Open the arive\_markers.dat file in notepad

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<sup>3</sup> The width of the black square is not set; you can make it to be a thin frame if you like, however, the thinner the black frame, the more difficult it will become for ARive to recognize the marker in poor lighting conditions.



It will look something like this:

2

**Data/patt.arivebig1**

**SINGLE**

**179**

**0.0 0.0**

**Data/arive\_2.patt**

**SINGLE**

**50.0**

**0.0 0.0**

The first number is the number of total markers used (yes, ARive actually supports two models on two markers in the same scene.)

The second is the path the first marker

4. Substitute **Data/patt.arivebig1** with your own marker

**179** is the width of the marker in millimeters, change this to the size of your new marker.

**Note:** ARive will work if you have the incorrect size set, however marker recognition might be poor, and your model will not be scaled properly.

5. Set the size of your marker
6. Start ARive and test your new marker



## Calibrating your camera properly

ARive, by default, is calibrated to use a Logitech QuickCam Pro 9000.

Although not strictly necessary; if you have another webcam than this, you will benefit greatly by calibrating your own camera for use with ARive.

–This will definitely increase the precision of marker-tracking, and reduce the “jitter” one often experiences with models jumping in and out of view on the marker.

The calibration data is stored in

(By default)

C:\Program Files\ARive RC1\data\camera\_para.dat

This file will need to be replaced by your own. –However the data input is created by calibration-software from ARTOOLKIT. –This is built-into ARive.

This is not really complicated, but a bit tedious. To get full instructions on the procedure, please visit the ARTOOLKIT documentation:

<http://www.hitl.washington.edu/artoolkit/documentation/usercalibration.htm>

This process is implemented like this in ARive;

1. Print the calibration sheets (located in the “C:\Program Files\ARive RC1\calib” –folder)
2. Start ARive
3. Open the Tools window
4. Run “Camera Distortion”
5. Write down the numeric parameters given in the end!
6. Run “Camera Calibration”
7. When prompted, save the file as camera\_para.dat
8. Copy your new file to “C:\Program Files\ARive RC1\data”
9. Overwrite your old file<sup>4</sup>
10. Test your new calibration.

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<sup>4</sup> It is a good safe-measure to back up your old file.



## Running ARive from the Command-line

ARive will hopefully support a number of features in the future, such as object occlusion, custom lighting etc.

Some of these functions are supported by the engine at the moment, but are not accessible from the graphical user interface.

ARive can be run from the command line in windows; in fact, the only thing the GUI does is to parse text-commands to the `arrive.exe` -file.

The syntax is:

```
arrive.exe [MODEL1] [SIZE] [SHIFT-X] [SHIFT-Y] [SHIFT-Z] [MODEL2] [SIZE] [SHIFT-X]  
[SHIFT-Y] [SHIFT-Z]
```

**I.e:**

```
arrive.exe mymodel.ive 100 0 0 0 mysecondmodel.ive 100 0 0 0
```

Where you have to specify two models; if you only use one, you can use the supplied `dummy.ive` file.

-If you fail to specify two models, however, ARive will crash when run.

The second model will be placed on a second marker that you will have to create yourself, and specify in the `arrive_markers.dat` file.