

# THE GRASSROOTS FABLAB INSTRUCTABLE

*or how to set up a FabLab in 7 days with 4 people and about €5000*

There are several ways to start a FabLab. A common approach is to convince local government, businesses and/or educational institutes, apply for funding and sponsorship, rent a place, hire a labmanager, and then start looking for users. We did it the other way and developed an extreme bottom up approach, skipping at least a year of preparation, and making active use of an existing group of enthusiastic artists, inventors and tinkerers.

**WARNING:** Steep learning curves ahead!\*

## DAY 1

- Gather a bunch of friends and decide to start a FabLab . The group shouldn't be too big for efficient decision making. If you already know each other you'll save a lot of time in finding out how to work together . A group of 4 or 5 tinkering friends will do.
- Put together about €5000 and order: a cheap laser cutter (€3400), a vinyl cutter (€700), a netbook (€200) and parts for the Mantis cnc mill (€200), leaving a €500 for various needs: more computers, a lab bike, a soldering station... Note: limiting laser- and vinyl cutter workareas to A4 the costs can even drop below €3000. Search for Bart Bakker's mini FabLab.
- Find a space to set up your lab. Your garage, an existing (arts or crafts) workshop, temporary space in a empty shop, a container, squatting an abandoned building or borrowing an empty corner in the hall of a local company. Be creative: the space doesn't have to last long. If your lab is successful you'll earn a more secure space sooner or later. It doesn't have to cost anything, as you can offer use of the machines and access to a creative network in return.
- Set up a simple website and announce the opening day of your FabLab to your network (the local press, social media and all your friends). FabLab Amersfoort created a lightweight open source tool called Hypha for this purpose. Check [www.hypha.net](http://www.hypha.net)

## DAY 2

- Brainwork: discuss whether you actually want to earn back the investments you did, or that having these machines at you disposal at a quarter of their actual cost and getting a network of creative geeks growing around you is rewarding enough. Choose a 'business model': a FabLab has to offer free opening hours, but you can still have separate commercial opening hours, go for government funding, use perceived value pricing, etc. Will you charge people for materials they use, or should they bring their own materials?
- Equip your space with a proper workbench , table, chairs and internet. Set up your fab-netbook(s) with Linux operating system, and install Inkscape, Blender, Pycam, Arduino, Processing and Ekiga. Connect to the FabLab mcu channel.
- Impatiently wait for the lasercutter to be delivered, check track-and-trace status every 30 minutes etc. While waiting, call a number of nearby hardware stores and ask whether you can pick up some of their waste material that can still be used in the FabLab. They're usually glad to reduce their garbage disposal costs. Also make a phone call to city hall and talk some government official (preferably the major) into officially opening your lab. Greatly helps in getting the press to cover your event.
- Add pictures of your space and text about the chosen business model to your website, and update your network.

## DAY 3

- Brainwork: decide how you will run the lab, considering opening times, labmanagers, maintenance etc . Again, this can be done low profile for a start. If you open one day a week and take turns as labmanager-on-duty, each of the founding tinkerers will have to serve only once a month in return for having access to the machines for the rest of the time.
- Install the arrived lasercutter and vinylcutter, and set up proper ventilation.
- Practice with the software and write (or copy) a quick starter manual for the various software packages.
- Add pictures of the machines and text on opening times to your website, and update your network .

#### **DAY 4**

- Brainwork: decide how your fabbers will connect to the community and document their work .
- Run a series of tests with various materials on your machines to get the hang of it and to create a table with machine settings for different materials.
- Cut out the Mantis wooden parts and build the frame.
- Update website and network with text and images.

#### **DAY 5**

- Brainwork: think up (or copy) a nice demonstration project to introduce your fabbers to the machines.
- Assemble and test the Mantis electronics.
- Write (or copy) a quick starter manual for each of your machines.
- Update website and network with text and images.

#### **DAY 6**

- Put up the FabLab Charter at the entrance.
- Buy drinks and snacks for the opening.
- Update website and network.
- Extension time\*

#### **DAY 7**

- Opening

#### **\*DISCLAIMER**

Although in principle this schedule could work out, be prepared for delays and frustration along the way: Suppliers can be hard to find. Open source software is sometimes still under heavy development, not (yet) well documented or unavailable for some platforms. Same goes for propriety software by the way, and then they charge you for it. Furthermore, cheap and open source don't always go together, especially cheap hardware often comes with a limited range of drivers, although some overseas suppliers don't seem to hesitate in providing you with a cracked version of the needed software and operating system.

Don't wait for approval by whatever officials. They don't understand the concept of a FabLab in the first place, they may come up with insane regulations, forms etc. Especially your alternative business model will not be recognized by politicians, businesses, and official institutions like the chamber of commerce.

*Harmen G. Zijp / FabLab Amersfoort*

## STARTUP CHEAT SHEET

To help you get started, here's our line-up of software, suppliers and machines. This may not always work outside the Netherlands.

### HARDWARE

- *Mantis* Small DIY mill suitable for PCB milling. URLs: [makeyourbot.wikidot.com](http://makeyourbot.wikidot.com), [wiki.protospace.nl](http://wiki.protospace.nl)
- *Calortrans CT-60* Cheap vinyl cutter. No official Linux support, however it works perfectly together with the Inkcute plugin for Inkscape. URLs: [www.signseen.nl](http://www.signseen.nl), [inkcut.sourceforge.net](http://inkcut.sourceforge.net)
- *Craft ROBO* Even cheaper vinyl cutter. Actually, our lab doesn't have this one, but several other startup labs do. Beware: no Linux support! URL: [www.craftrobostore.com](http://www.craftrobostore.com)
- *Morntech* Chinese laser cutter. Not very robust. Not very much service. Comes with Chinese manual and cracked propriety software and drivers. You'll have to add your own safety switches. But... it does the job at a fraction of the cost of a high end machine. By the way, work is being done on an open source laser cutter driver, which should overcome a major obstacle in using this machine. URL: [www.morntech-europe.com](http://www.morntech-europe.com), [wiki.laoslaser.org](http://wiki.laoslaser.org)
- *Ultimaker* DIY 3D printer developed at ProtoSpace. URL: [wiki.protospace.nl](http://wiki.protospace.nl)
- *USBtinyISP* Inexpensive USB AVR programmer. Works together with Arduino. URL: [www.ladyada.net/make/usbtinyisp](http://www.ladyada.net/make/usbtinyisp)
- *Acer Aspire One* netbook. One version came with a solid state drive and a Linux operating system for some time, which made it very affordable. URL: [www.linux-netbook.com](http://www.linux-netbook.com)
- *Mini ITX boards* come in many flavours from a range of manufacturers. If you run the operating system from a USB drive and lasercut your own case around it, you can have a pretty fast machine for under €100. Remember, screens are for free nowadays if you don't need a flat one. URL: [www.mini-itx.com](http://www.mini-itx.com)

### SOFTWARE

- *Crunchbang Linux* A minimalist Linux distribution with an active community and helpful forum. It features a good trade-off between open source policy and hardware support. It is very light weight and highly configurable which makes it very suitable to run smoothly on cheap, old or otherwise limited hardware. URL: [www.crunchbanglinux.org](http://www.crunchbanglinux.org)
- *Inkscape* Software for 2D vector drawings. It has plugins for generating HPGL and gcode. URL: [www.inkscape.org](http://www.inkscape.org)
- *Blender* Software for 3D design (and animation). It has a steep learning curve, but has a broad user- and developerbase, and is the only advanced 3D package around that is open source. URL: [www.blender.org](http://www.blender.org)
- *Pycam* Toolpath generator for 3-axis CNC machining, with a very active development team. URL: [pycam.sourceforge.net](http://pycam.sourceforge.net)
- *ReplicatorG* 3D printing software that connects to most DIY 3D printers, as well as the Mantis when the Ultimaker board is used as a controller. URL: [www.replicat.org](http://www.replicat.org)
- *Processing* Cross platform rapid prototyping in software. Easy programming environment, many examples to start from, good reference manual and forum. URL: [www.processing.org](http://www.processing.org)
- *Arduino* User friendly programming tool for the AVR family of microcontrollers. Look and feel are similar to processing. Works both with the official Arduino board and many derivatives. URL: [www.arduino.cc](http://www.arduino.cc)
- *Ekiga* Voice-over-IP software which can be used to connect to the FabLab video channel. URL: [www.ekiga.org](http://www.ekiga.org)
- *Dosis* Configuration script that installs all of above software on a fresh Crunchbang Linux install. URL: [www.giplt.nl/dosis](http://www.giplt.nl/dosis)
- *Linux-cnc* Dedicated Linux distribution optimized for accurately driving milling equipment over a parallel port. URL: [www.linuxcnc.org](http://www.linuxcnc.org)

### WEBSITE

- *Hypha* Lightweight user-friendly wiki/cms for running a website. Modules for including SVG files and fabmoments/instructables are under development. URL: [www.hypha.net](http://www.hypha.net)