

Fabricating Labs

**Guidelines for designing and  
planning Fab Labs, Makerspaces and  
Innovation Facilities**

by Francisco Sanchez Arroyo  
The (Fabulous) Beach Lab

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## Disclaimer

This guide is work in progress. It is not yet complete and might contain missing and/or incorrect information. Handle with care.

## 1 Introduction

Are you planning to set up a Fab Lab or Makerspace? The most common mistake is starting by placing the machines and then figuring out the rest. But did you think about the workflow around each machine? Are the other uses inside that room compatible with your process? This Guide is intended to help identifying those workflows, cover the basic requirements and to avoid having future problems related to inadequate planning.

### 1.1 Levels of assessment

Planning a Fab Lab should be assessed in increasingly 4 levels of detail in that specific order:

- The machine or process. Each machine and process has its own requirements.
- The workflow around that machine or process. A machine is usually part of a bigger process or workflow, whose requirements you need to analyse too.
- The room containing that workflow must be analysed specially looking for incompatibilities regarding noise, dust, ventilation, etc.
- The building containing that room must be assessed as well. High frequency vibrations created by digital fabrication machines can travel through the structure of the building causing trouble in very far areas from its origin.

### 1.2 List of requirements to be assessed

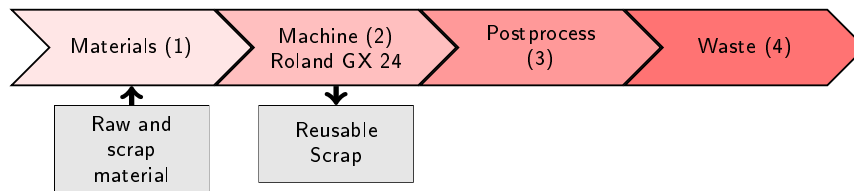
For each of the above levels of assessment we will identify the following requirements:

- Lighting
- HVAC systems
- Piping and plumbing
- Mechanical requirements
- Power and electrical requirements

- Materials management (storage and locking requirements)
- Waste management
- Health and Safety
- Ergonomy

## 2 Processes and Workflows found in a Fab Lab

### 2.1 Vinyl Cutting



#### Notes

- (1) Additional items: X-acto, scissors, masking tape, vinyl gloves
- (2) This area requires also space for a computer for design and operation tasks. Provide enough power plugs (minimum 3)
- (2) The back of the machine must be reachable
- (2) Additional items: Tweezers, X-acto, scissors
- (3) This area requires the width of the biggest roll that the machine can handle and plenty of light
- (3) Additional items: Tweezers, X-acto, scissors
- (4) Waste: Paper backing, vinyl, Copper film, epoxy film.

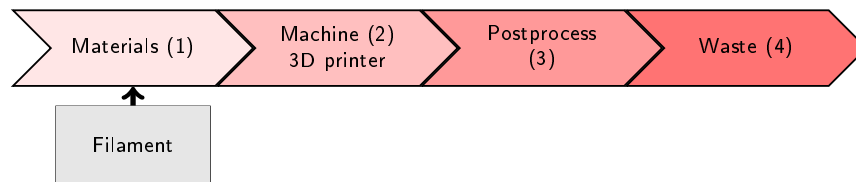
#### Risks

- Hand trapped by machine movement
- Cuts with sharp objects

#### Personal Protective Elements (PPE)

- None required

## 2.2 3D Printing FDS



### Notes

- (1) Filaments require low moisture environment
- (3) Additional items: Wire cutter, spatula
- (2) Machine requires rear inspection
- (2) Power requirements: Most 3D printers don't require a computer. Newest require network connection.
- (2) HVAC direct airflow or low room temperature might affect buildplate adhesion and layer cooling
- (3) Additional items: X-acto, pliers, wire cutter
- (4) PLA and ABS based plastics

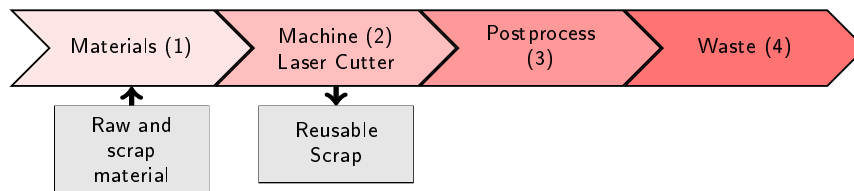
### Risks

- Hand trapped by machine movement
- Burn by nozzle or buildplate
- Hot plastic splatters caused by moisture inside filament

### Personal Protective Elements (PPE)

- Eye protection is recommended for kids

## 2.3 Laser Cutting



### Notes

- (1) Maintaining order of scrap material is important
- (1) Cardboard and wood are sensitive to moisture
- (2) The room requires ventilation and air renovation from exterior
- (2) The laser is usually a noisy environment, specially if there is also a filter installed
- (2) It is required also space for computer for design and operation of the laser
- (2) Power requirements: Provide at least 6 power plugs
- (3) Clean up scrap material and store it in (1)
- (4) Cardboard, wood, plastics

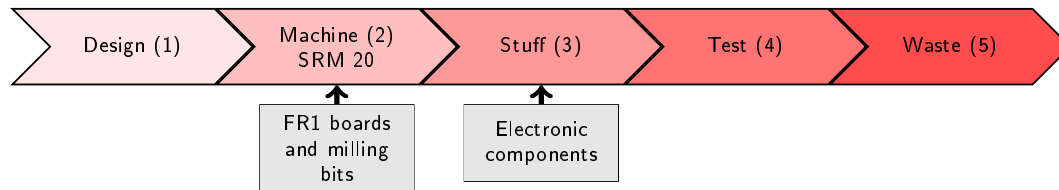
### Risks

- Health issues due to long-term exposure to fumes
- Cuts by sharp edges of material

### Personal Protective Elements (PPE)

- Recommended gloves for handling material and scrap

## 2.4 Electronics Production



### Notes

- (1) Area for a computer next to the machine for design and machine operation. 3 power plugs
- (2) Additional items: Spatula, double-side tape, X-acto, Allen keys for milling bits, magnets
- (3) 2 seats area for soldering operators
- (3) Easily accessible cabinets with electronic components
- (3) This area requires ventilation and air renovation, plenty of light and magnifying equipment
- (3) Power requirements for 2 seats: 6 plugs
- (4) 2 seats area for power supply, oscilloscope and function generator. Power requirements 6 plugs
- (5) Waste: Paper dust, FR1 boards, broken bits, electronic components

### Risks

- Fumes inhalation
- Electric shock
- Cuts by sharp objects
- Burns by soldering iron

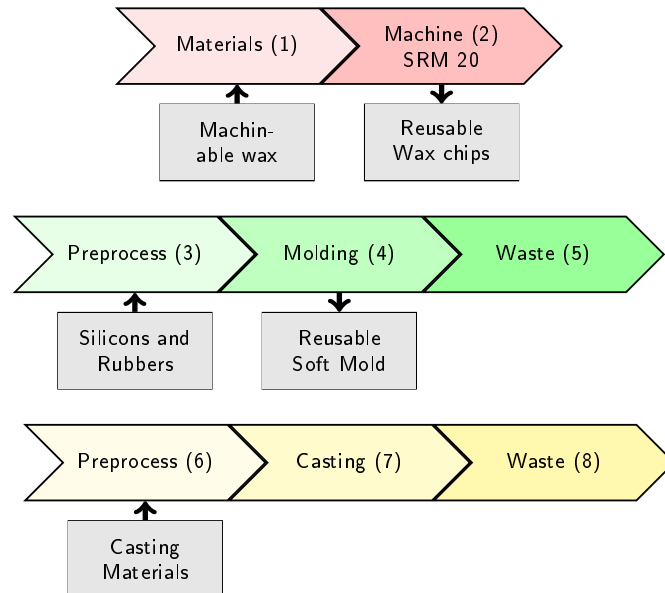
### Personal Protective Elements (PPE)

- Gloves for removing boards and soldering
- Eye protection for soldering
- Isolating shoes



## 2.5 Molding and Casting

Molding and casting is a 3-phase process that can be done at different time and in separated rooms



### Notes

- (1)(2) Phase 1 can be executed in the same room as electronics production. But it requires to clean and vacuum the machine and surrounding area prior to milling the wax. This phase produces virtually zero waste. A dedicated vacuum machine or a clean brush is recommended to pick up all the wax chips for future use.
- Phase 2 and Phase 3 can be executed in a separate room. These phases require a ventilated area and access to water and a sink.
- (3) Refer to MSDS for important health and safety information
- (4) Store reusable molds in the same storage room as silicones
- (5) Waste: Pots, gloves, sticks, etc, stained with silicones and rubbers
- (8) Waste: Pots, gloves, sticks, etc, stained with casting materials

### Risks

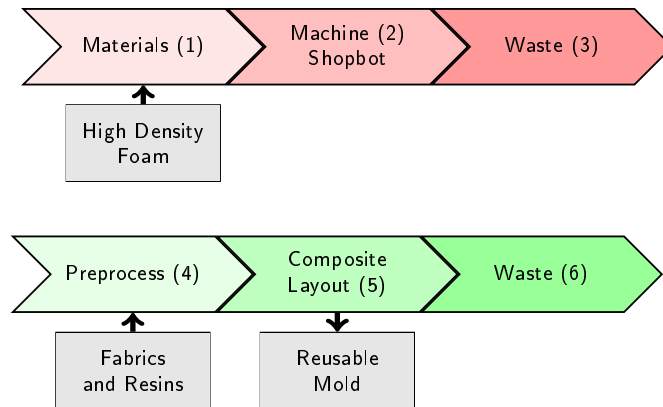
- Inhalation of dangerous volatile substances
- Eye, skin and lung irritation

### Personal Protective Elements (PPE)

- Lab coat, vinyl gloves and eye protection during the molding and casting phases
- Masks and respirators upon the MSDS specs of the materials

## 2.6 Composites

Composites is a 2-phase process that can be done at different time and in separated rooms



### Notes

- (2) Room containing the Shopbot is a very noisy, dusty and dangerous environment. Recommended separate room.
- (2) Room containing the Shopbot must have ventilation and filtration system. Refer to calculations in following sections.
- (3) Waste: Foam dust, high density foam
- (4) This phase requires a ventilated area and access to water and a sink
- (5) Store reusable molds in (1)
- (6) Waste: Sand paper and resin dust

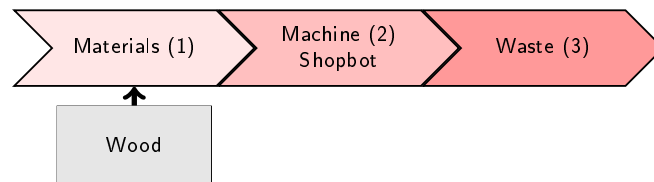
### Risks

- Fine dust particles inhalation in milling phase
- Fast spinning cutting tool in milling phase
- Debris in milling phase
- Noise damage
- Being trapped by moving machine or spindle
- Eye, skin and lung irritation due to resins

**Personal Protective Elements (PPE)**

- Eye, ear protection
- Appropriate gloves for handling materials
- Coat, eye protection, gloves and mask/respirators during composite layout phase

## 2.7 Large CNC



### Notes

- (2) Room containing the Shopbot is a very noisy, dusty and dangerous environment. Recommended separate room.
- (2) Room containing the Shopbot must have ventilation and filtration system. Refer to calculations in following sections.

### Risks

- Fine dust particles inhalation in milling phase
- Fast spinning cutting tool in milling phase
- Debris in milling phase
- Being trapped by moving machine or spindle

### Personal Protective Elements (PPE)

- Eye, ear protection
- Appropriate gloves for handling materials

## 3 Technical aspects

## 4 What's next?