

GNG1103  
**Design Project User and Product Manual**

**Loose Screws Guardian Program Building**

Submitted by:

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Figure 1: Laser Cut 3D Model Prototype

# **1 Introduction**

This User and Product Manual provides the information necessary for The Guardian Project to effectively use the Guardian Program Building prototype and prototype documentation. This document includes important considerations, safety procedures, storage requirements, build instructions, maintenance procedures, cost estimations, materials needed, and equipment required to successfully build, use, and maintain the Guardian Program Building prototype.

## 2 Overview

The problem that was faced was building an environmentally, culturally inclusive and accessible office building that reflects the “Guardian Program.” This building is important to the client because they did not have a main office building for their program.

The main needs the client needed us to meet were for the building to reflect the culture of the Algonquins, for it to be accessible for everybody, and for the office to be environmentally friendly to line up with their morals.

Our building differentiated from other buildings with our main piece being the main courtyard, the courtyard featured a water fountain, benches and much more to be a quiet and calm place for private meetings. The activity area we designed fit also had cultural and environmental aspects added to it. Aspects such as solar panel lamps and a garden were added to give a sense of mother nature along with tables, a gazebo, and an open “field” for any community events.

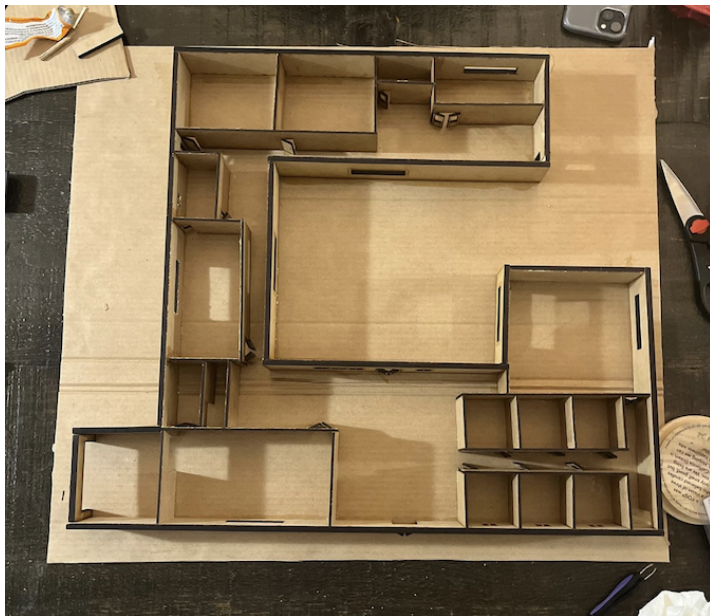


Figure 1: Laser Cut 3D Model Prototype

Main features include the courtyard that acts as a nice meeting area with plenty of greenery, the lab which includes the mobile plant processing station and walk in freezer, and lastly and the main office space which includes a main office room (15+ workspaces: 12 cubicles and tables for additional workspaces) and 6 private offices.

## **3 Getting started**

### **3.1 Configuration Considerations**

### **3.2 Accessing/setting up the System**

In order to set up the system, all pieces need to be printed and an adhesive needs to be accessible to be used. Following the building layout, all of the pieces can be put together. There is room for personalization in the floor plan and room orientation. However, if changes are made in the layout, dimensions may need to be altered.

### **3.3 System Organization & Navigation**

The system consists of the main outside walls and interior walls which include cutouts for windows and doors. Interior furniture elements such as counters, stalls, offices, tables, doors etc are also included in the prototype. Outside elements such as the activity area include a gazebo, various seating and decor elements as well. All components of the system are brought together on a platform of cardboard where pieces are glued onto the cardboard as well as together where they intersect.

### **3.4 Exiting the System**

The system should be stored in a room temperature environment, to disassemble the system heat up the glue to a temperature where it no longer is able to hold the MDF and it will come apart into many pieces.

## **4 Troubleshooting & Support**

### **4.1 Error Messages or Behaviors**

Smaller MDF cutouts are prone to breakage and/or will be difficult to remove from the mold if the cut did not go all the way through, be careful when removing them from the board. If necessary use an exacto knife, heat, or recut that specific piece.

### **4.2 Special Considerations**

If any fitment issues should occur when constructing the system ensure the calibration of the cutter is accurate. Refer to the specific manual of your cutter for instructions.

### **4.3 Maintenance**

Maintain a constant ambient temperature close to that of standard room temperature as to not compromise the integrity of the wood glue used to maintain the rigidity of the prototype's structure.



## 5 Product Documentation

### 5.1 MDF Laser Cut Prototype

#### 5.1.1 BOM (Bill of Materials)

Item Name	Description	Type	Cost	Prototype #	Source
Autocad	CAD program to create 3D sites - autodesk	Virtual Prototype	Free	Final	<a href="#">Link</a>
Laser Cutting	Proportional 3D model of the building	Physical Prototype - Using 1/4 MDF	\$3.5/sheet	Final	<a href="#">Link</a>
Glue	For reinforcing the model	Physical Prototype - Using 1/4 MDF	\$1.25 each	Final	in store purchase

#### 5.1.2 Equipment list

Item Name	Description	Prerequisites
Laser Cutter	Laser engraving/cutting machine	Associated equipment training and safety knowledge
Exacto Knife	Sharp knife to assist in cutting out pieces from the MDF board.	N/A

#### 5.1.3 Goal of the Physical Model and Process

The goal of the laser cut physical prototype was to make a scaled down version of the to scale 3D autocad model of the Guardian Building. The 9028 square feet building consists of 12' high walls, of 6' wide hallways, and of the following 11 subsystems with their respective dimensions.

- 40'x21' laboratory
- 18.5'x38' common room
- 10'x14' kitchenette

- 24.5'x20' bathroom (x2 for men and women)
- 26.5'x13' boardroom
- 12'x12' single office (x6)
- 30.5'x29.5' office common space
- 20'x20' lean-to
- 15.5'x15.5' laboratory storage
- 17'x9' maintenance storage
- 3'x6' closet

To create a proportional laser cut model, we determine a scale factor where the largest dimension of the model (which is the front wall) did not exceed 2 feet. Therefore, dividing 2 by the longest wall gave us a scale factor of 0.0146. With the scale factor, we determined the new dimensions of the subsystems and the outside walls of the building. We recommend using a spreadsheet (figure below) to track the actual and scale down dimension since it makes the calculation and the design easier.

	Wall Number	Actual (in)	Scaled Down
Outside walls	1	1637.5823	23.90870158
	2	240	3.504
	3	252	3.6792
	4	1122	16.3812
	5	1140	16.644
	6	318	4.6428
	7	837	12.2202
	8	588	8.5848
	9	704.5823	10.28690158
	10	288	4.2048
	11	384	5.6064
	12	730.5	10.6653
			0

Figure: Example of a dimension spreadsheet

Once all the dimensions of the building walls have been scaled down, we created the PDF files that will be used to laser cut all the pieces using *Inkscape* – the rectangle tool is the most useful for this project. A rectangular frame with holes for doors and windows added to the

appropriate walls will make up all the necessary pieces for the building structure. For cutting, the thickness of lines are 0.001 inches and for etching, the thickness of the lines are 0.032 inches. Using  $\frac{1}{4}$  inch MDF for the outside walls and  $\frac{1}{8}$  inch MDF for the inside walls, all the walls were ready to be laser cut. Examples of the outside walls to cut can be found [here](#).

To put all the walls together we used *Stuch Contact Cement Adhesive*. We applied it to each piece that was to be connected, held it in place for approximately a minute, then left it to completely dry for 2-3 hours.

The decoration can be to the individual's tastes. In terms of our model, we used the door cutouts to build small tables instead of printing more pieces, and printed some art work on paper to glue on the inside walls as an example of what can be done.


Overall, the creation of the physical laser cut model is straightforward and leaves room for mistakes and changes since it's a fast and easy process.

#### **6.1.4 Instructions for a Laser Cut Model**

1. Determine a scale for the physical prototype
2. Using the scale, calculate the scaled down dimensions
3. Create the necessary pieces on *Inkscape*. Download as a PDF
4. Laser Cut all pieces
5. Using *Stuch Contact Cement Adhesive*, glue the pieces in the proper layout and allow to dry.
6. Once completely dry, decorate as one desires

## 5.2 Testing & Validation

<b>Test ID</b>	<b>Results</b>
<b>1. Sanity &amp; Safety Check</b>	Fire exits were added in different parts of the building to meet safety standards and provide easy exit in case of an emergency.
<b>2 Peer Feedback</b>	During peer feedback testing, five people were surveyed on their opinion of our final layout and design, their feedback was a positive confirmation that the building's design makes sense and is logically designed.
<b>3 Client feedback</b>	<p>We received the feedback from client meeting 3, in which they stated the following:</p> <ul style="list-style-type: none"><li>● Lean to and the lab should have a big loading door if not already<ul style="list-style-type: none"><li>○ We already have a large garage door</li></ul></li><li>● More office spaces would be beneficial if possible.</li></ul> <p>The reason they requested more office spaces is due to some misunderstanding and confusion about the design of our big main</p>

	<p>office room, which is designed for 15+ office spaces (including 8 cubicles and additional table workspaces). Since our first prototype (which is what they saw) only showed the outside walls, they interpreted the big main office as for one person, which is not the case.</p> <p>They liked:</p> <ul style="list-style-type: none"> <li>● The lean to off the lab and their location</li> <li>● The storage rooms</li> <li>● The outside green areas</li> <li>● The solar lamps</li> </ul>
<p><b>4 Cost Estimate</b></p>	<p>After receiving all final client &amp; peer feedback on our prototype, we updated the BOM and cost estimate as needed.</p> <p> Deliverable H Project Cost</p>

Based on the client feedback, there was not much we needed to change or improve. During peer feedback, we only received positive confirmation that our design looks good and appears to functionally serve its purpose.

## **6 Conclusions and Recommendations for Future Work**

There were plenty of lessons learned from writing the deliverables to creating the prototype, some more important than others. When writing the deliverables it was important that we made sure to split the work evenly so no one was working more than they should've been, there would be times where someone was working more than another person and from that we know there should be more communication. When working in a group it is very important to communicate and make sure that everyone is comfortable with the work they are assigned and that everyone can agree on the vision of the project. This makes working in a group much more productive since if everyone is satisfied work flow is smooth.

With the time we had we made good use of it, but if we were given much more time on it there would be a lot of improvements made to the infrastructure. Furthermore, the team had spent lots of time trying to meet the requirements of the client by making an accessible, culture induced and environmentally friendly building. Initially for our last prototype we wanted to 3D print the individual rooms then put the building together, but considering how long and how easy 3D printing is to mess up we had to scrap that idea and laser cut the building, this did make the building turn out a lot better in the end.

## 7 **Bibliography**

N/A

# APPENDICES

## 8 APPENDIX I: Design Files

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Customer Needs	<a href="#">W Customers needs/priority template....</a>	Sep 25, 2023
Design Criteria	<a href="#">E Deliverable C Group 10 GNG1103</a>	Oct 8, 2023
Conceptual Design	<a href="#">E Deliverable D Group 10 GNG1103</a>	Oct 15, 2023
Product Schedule and Costs	<a href="#">E Deliverable E Group 10 GNG1103</a>	Oct 22, 2023



## 9 APPENDIX II: Other Appendices