**THE HATCHERY**

INTRODUCTION

The Hatchery is a mobile work machine that provides a framework for a unique self-build system of construction that enables countless other projects around Fly Ranch to be possible.

While the proposal is primarily a broad system of construction addressing the needs for shelter, the example pictured here is a prototype of the proposed construction system as well as the primary tool needed for the system to be possible. Taking the form of a slow moving animal roaming through the fields of Fly Ranch, its dyed thatch skin — inspired by the indigenious technology of early Paiute shelters — attempts to merge with the landscape in celebration of the stunning natural beauty of Fly Ranch.

SHELTER

The prototype is a digital-fabrication maker-space that utilizes CNC as its primary technology, enabling on-site fabrication of modular components made out of 4’ x 8’ plywood that can easily be handled and assembled by anyone with simple hand-tools. This structural kit-of-parts is a highly flexible construction system that allows short or long-term use structures to be efficiently built with speed and easily reconfigured for other uses. It would support a wide variety of regenerative construction activities, including building of physical infrastructure for food and energy production, temporary lodging, community hubs, docks, and walkways.

REGENERATION

This project is a piece of regenerative infrastructure because it is a piece of hardware that can be used to build other projects that address all areas of the LAGI competition, empowering others to build their own creations. As a piece of social infrastructure, the project is also a hub for makers, artists, and creators to come together, learn and develop ideas, and form a community around making and doing. In this spirit of Burning Man, this project allows maximum creative freedom from the individual to the collective scale.

Through innovation of ancient materials and technologies, this proposal is the perfect fit for the Fly Ranch project to pioneer new forms of architecture that will set an example for a sustainable future, offering new ways of working and living in harmony with the land and each other.

**TECHNOLOGY**

FLEXIBLE CONSTRUCTION SYSTEM

The primary technology is a modular structural system that helps you design and build your own customisable buildings utilizing digital design and manufacturing.

Instructions for creating structural parts are first drawn on the computer using a digital model, and then cut from flat sheets of plywood using a CNC machine. The parts can easily be slotted together to form a structural box-like unit with simple hand tools. Modules can be easily handled by just one or two people and bolted together to form a solid structural frame. Once the structural system is assembled, interior and exterior cladding can be applied.

The basic system can easily be adapted and modified to create any more complex shapes, limited only by the size of the raw material being cut, meaning the creator has near endless possibilities. For creating high-performing shelters, the inner cavity can be packed with wool, straw, and sawdust (the process' waste material) to create insulation.

CNC MACHINE

The smaller of the two prototype vehicles contains a high-efficiency CNC (Computer Numerically Controlled) machine and the router processes flat raw material into 2D and 3D shapes, with high speed and accuracy. With redesigned electrical control systems for maximum efficiency, the machine can run on about the same power it takes to run a blender.

AUXILIARY WORKSHOP

The larger vehicle is an auxiliary wood workshop that has storage for tools and raw material, as well as a large adjustable work surface and countertops.

SOLAR POWER

A solar panel array on one side of the vehicle will generate power for the workshop. By adjusting the angle (36 degrees tilt is the ideal angle for Nevada), and positioning the vehicle at the right position, the optimum conditions for maximizing solar gain can be easily achieved. As drawn, the 8 panels can produce an estimated 2.56kw per hour. Additional solar panels can be added as power consumption requires, and solar energy that is collected throughout the day can be stored in an on-board battery pack for later use.

RAINWATER HARVESTING

An onboard rainwater harvesting system collects water that can be used for general washing and as needed in part of the thatch dying process. Rainwater is collected in a series of fabric funnels connected to collection barrels. Used gray water can be stored and later filtered at a dedicated site. As currently drawn, the system has the ability to capture 89 gallons of water for every 1" of rainfall, and a 165 gallon storage capacity. Rainwater collection is optimized when the solar panels are in the stowed (vertical) position, and additional storage barrels can be added as required.

DYED THATCH

Grass is an abundantly available natural resource at Fly Ranch that can be used to create the distinctive thatched cladding shown in this proposal. Inspiration is drawn from the indigienous technology of the Paiute Tribe, whose early shelters called “wickiups,” were created using branches, sticks, and grass, in a prime example of sustainable building. Taking this technology one step further with the aim of not trying to copy or appropriate, this project proposes to dye the thatch in all-natural dyes and create a “skin” that draws from the colors, patterns, and texture of the landscapes outstanding natural beauty.

First, grass from Fly Ranch is cut and thrashed on site. The cut grass is first bundled into units called yearns, which are then soaked in all-natural dyes to attain a wide variety of colors Finally, the years are attached to substructural purlins either by sewing or mechanical fixing.

MOBILITY

The Hatchery is inspired by a Burning Man favorite: the art cars. Drawing from this unique and contextual precedent, the flexibility afforded to a mobile workshop means that The Hatchery can build locally at any project location in Fly Ranch. Additional carts can be chained up as other functional needs arise. To maintain 100% carbon neutrality, the train of machines can be towed by a bio-fueled vehicle or another 100% sustainable fuel source.

**SUPPORTED ACTIVITIES**

* CNC Fabrication of shelter and infrastructure
* Hub for learning and knowledge-sharing
* Carpentry and woodworking making activities
* Solar energy collection
* Rainwater harvesting

**SYSTEM INPUTS**

* Raw Material (Plywood)
* Power: estimated approx 2.2 KwH
  + CNC with 2.2 HP router = 1.65 KwH
  + CNC motors and electronics = .5 KwH
  + Laptop = 0.05 KwH
* Sunlight
* Rainwater
* Biofuel (for woodchipper)

**SYSTEM OUTPUTS**

* Wood Components for shelter construction
* Sawdust (to be used for insulation, mulch, animal bedding, heat, or biofuel)
* Solar Power: estimated 2.56 KwH (320 watts/panel x 8 panels)
* Rainwater: estimated 89 gallons of water for every 1" of rainfall

**PRIMARY MATERIALS**

* Sustainable 100% FSC Certified Plywood

**ORDER OF MAGNITUDE COST ESTIMATE**

|  |  |  |  |
| --- | --- | --- | --- |
| **Materials** | | | **4000** |
| Plywood (est 80 sheets) | 80 | $4000 | $4000 |
| Donated Used Trailer bed | 2 | 0 | $0 |
| **Tools and consumables** | | | **12600** |
| CNC machine | 1 | $6000 | $6000 |
| Woodchipper | 1 | $3000 | $3000 |
| Carpentry tools |  | $600 | $600 |
| Consumables |  | $500 | $500 |
| Hardware |  | $500 | $500 |
| Dedicated Computer | 1 | $1000 | $1000 |
| Conduit and Wiring |  | $1000 | $1000 |
| **Power** | | | **2800** |
| PV panels | 8 | $350 | $2800 |
| **Rainwater System** |  |  | **$800** |
| 55 gal drum | 3 | $100 | $300 |
| Collection system |  | $500 | $500 |
| **Total** | | | |
| sum |  |  | **$20,200** |

**ON-SITE PROTOTYPE STRATEGY SUMMARY**

The proposal can be scaled or adapted as needed to fit budget requirements. This proposal is unique because once built, it is a piece of hardware that could be part of other projects' on-site construction strategy, lowering their costs and increasing feasibility.

The proposed prototype could be built on site at Fly Ranch, using the proposed CNC technology and construction system, or anywhere else in the US and sustainable delivered to Fly Ranch. If built on-site, procurement of supplies and tool would take place as locally as possible. A CNC machine and trailer bed would be the first procurements needed.

**ENVIRONMENTAL IMPACT SUMMARY**

STATEMENT

For functional use of Fly Ranch property in line with Burning Man Foundation’s purpose and strategic goals, there is a marked need for constructions that provide shelter and perform strategic functions for usage of the site. The proposed system aims to build structures with the lightest touch possible on the environment and provides a framework for creation of 100% carbon neutral structures across Fly Ranch, while also partaking in the new circular economy. This proposal utilizes only materials that are regional, renewable, and natural to build. Using CNC cut plywood as its primary material, structures and artworks built at Fly Ranch act as carbon stores, effectively offsetting any carbon produced in other processes or elsewhere. It is a closed loop construction process that effectively produces no waste, and affords flexibility of future adaptation rather than recycle. The more we build with timber, the more demand we create, which could ultimately lead to large scale reforestation of the planet, which is one of the only viable ways of stopping and reversing global warming. It is far superior when compared to alternative materials used for building, and could be an exemplar project for sustainable building practices needed for the future longevity of the human race.

LIFECYLE OF PLYWOOD USED AT FLY RANCH

1. 100% Certified FSC (Forest Stewardship Council) plywood is made from wood grown sustainable in managed forests and is formaldehyde free. It can be sourced regionally from West coast states of the US
2. Forests absorb carbon from the atmosphere, and trees are a renewable resource that can be replanted when cut down, thus maintaining the carbon cycle.
3. Cut timber acts as a long-term carbon store, effectively offsetting carbon produced in other building processes, such as processing of timber into plywood and transportation.
4. Production of plywood is a closed loop process in which most waste is reused.
5. Raw material should be transported to Fly Ranch with a zero-emission vehicle.
6. Structures built at Fly ranch store carbon in their structures for the period of their maintained life. Care would be taken to ensure no coatings or treatments would be applied that could contaminate the plywood for future reusability.
7. Waste offcuts produced during the construction process on Fly Ranch can be turned into sawdust using a bio-fuel powered wood-chipper. Sawdust that can be used for a wide variety of other useful purposes such as insulation, mulch, animal bedding, heating, or fuel.
8. Plywood can be ultimately reused by demounting structures and re-assembling them in new forms at the end of initial life, or recycled into sawdust. With the exception of burning for fuel, most of these recycled uses extend the storage of carbon in the material.
9. Wood eventually returns to the earth, supporting growth of new forests and effectively starting the cycle again.

UNAVOIDABLE ISSUES AND MITIGATION

* Energy-intensive processing of wood into plywood
  + The carbon store property of the timber itself goes a long way to offset energy used in this stage of manufacture
  + Offset credits could be purchased to mitigate this
* Transportation of raw material (plywood) to site from nearest regional supplier
  + Ship with a carrier using a zero-emissions vehicle, or pickup with a Fly-Ranch owned zero-emissions vehicle.
* Consumables such as router bits and screws need to be ordered and shipped to site
  + Carefully vet suppliers for their commitment to sustainability practices and source as locally as possible.
  + Pick-up or have delivered with a zero-emissions vehicle
* CNC machining is a power-intensive process
  + Carefully optimized electronics allow the router to run on minimal power about equal to that of a household kitchen blender
  + AC power can be sourced from onboard solar powered battery
* Woodchipper typically requires gasoline for processing of byproducts into useful sawdust
  + Equipment can be modified to run on ethanol or bio-fuel.