Art Grant Proposal to Burning Man

Project: **Luminosa - The Light Trees**

Artist: **Bill Watson**

Website: **http://www.lighttrees.com**

General Description:

The Light Trees are a luminous grove of trees with leaves that glow with vibrant colors and patterns. The grove is an inviting space where people can relax and enjoy the constantly changing ambience created by light flowing from the trees. The trees respond to a variety of stimulus, such as sound and movement near the trees. There are also controls that allow the participants to directly control the colors and patterns of the luminous leaves.

At various times of the week there will be performances created for the Light Trees with music, fire spinning and dance choreographed to the Light Trees that uses full capabilities of the lighting technology.

The Light Trees are also intended to be a social gathering place that creates an energizing and inspiring environment, and provides a perfect place for spontaneous and creative acts to occur. For the observer, the Light Trees can remind people of the beauty and possibilities that life has to offer.

Technical Description:

There are three trees in the grove. The trees are arranged in a circle 35 feet in diameter. Each tree is 18 feet tall and 10 feet in diameter. The trees are made of bamboo with metal connectors at joints, and EMT to support the leaves.

Each tree requires 3 buried metal footings to secure and stabilized the tree. These temporary footings are anchored to the playa with long metal stakes.

Each tree has 64 Plexiglas leaves that are illuminated by RGB Light Emitting Diodes (LEDs). The LEDs are controlled by a computer, and can be made to display any color and change the color virtually instantly. This gives the Light Trees the ability to display complex and rapidly changing patterns of light.

The trees are powered and controlled by a single cable running to each tree. Cables to the trees are buried 10 inches underground and will not degrade or contaminate the playa. Voltage is 3.6V and poses no shock risk.

There is a small shed nearby that houses the power and control equipment and has a filtered air intake to reduce dust. The shed also provides security for the equipment, and a place to control the trees during performances.

Power is provided by solar panels with a gas generator backup. Cables from the PV panels to the shed will be buried. Batteries and fuel containers are located in the shed for security and to prevent contaminating the playa.

A small sound system will be installed. Volume will be a non-issue.

Philosophical Statement:

The light and power of the Sun has made life possible on our planet. Light has literally been the energy behind the evolutionary progression towards more complex and increasingly conscious life forms. Light sustains life on our planet. Light also teaches us about the reality of the Cosmos through the transmission of information.

Of all species, humans have reached the highest level of consciousness. Along with this increased consciousness has come the ability to channel and control information in ways that transmit pure consciousness. Direct and immediate communication of thoughts and emotions between groups or individuals, located anywhere, is characteristic of 21st Century lifestyle.

Trees on Earth have evolved to reach towards the sky and draw energy from the Sun as part of their metabolism. Trees are a living part of the Earth's ecosystem and they support Life with their own lives. The Light Trees do much of the same thing but in reverse. They draw from the Sun and from Life on Earth and release light back into the sky. And so the most appropriate life form for telling our story with light are trees through their organic form.

The Light Trees are an embodiment of mankind's accumulated knowledge and advanced technologies into a physical, organic form that allows thoughts and emotions to be conveyed. The interpretation of human experience thru light is an attempt to manifest the Mother Light that makes life possible, and the Universal Consciousness that is within all existence. Light created life, and life evolved to create the Light Trees, which returns light back to the source with a message of Mankind's own experience and hopes for the future.
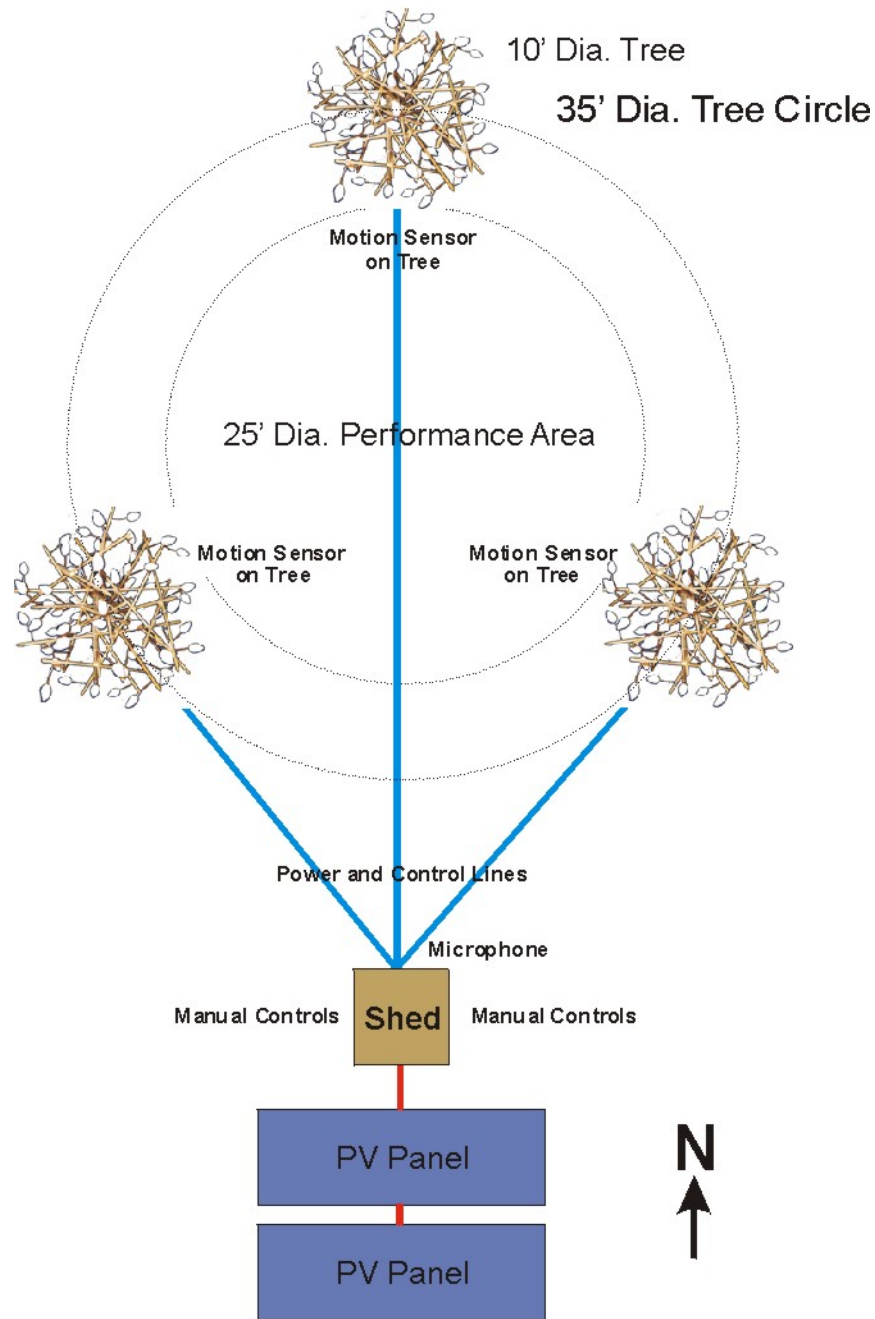
They are a lot of fun too :-)

Sound Bite:

Light comes full circle… from the Sun, to the Earth, to Life on Earth, to the Light Trees, and back to light radiating out into the Cosmos… carrying the story of Mankind's accumulated experiences and the messages of our collective consciousness, shared emotions and universal soul.

Detailed Drawings, Sketches, and Plans

Luminosa ~ The Light Trees
Scale Model

10' Dia. Tree

35' Dia. Tree Circle

Motion Sensor
on Tree

25' Dia. Performance Area

Motion Sensor
on Tree

Motion Sensor
on Tree

Power and Control Lines

Microphone

Manual Controls   Shed   Manual Controls

PV Panel

PV Panel

N

Three cables run to the trees, providing power for the tree electronics and LED lights. They also control the brightness and color of each leaf in real time. The electronics allows the color of every single leaf of all three trees to be changed to any value 88.8 times a second. This will allow spectacular color effects to be displayed, limited only by the control software and skill of the artist. The "flicker rate" of the LEDs is 558Hz, meaning there will be no noticeable flicker. The trees can operate unattended (which will be most of the time) and can be controlled by a laptop computer for special performances. Motion sensors on each tree, and a microphone, provide feedback to the control electronics that makes the trees responsive to the participants at Burning Man.

The primary source of electrical power will come from a photovoltaic system. Power from the PV panels is routed into the shed where a charge controller stores energy in a bank of deep-cell batteries. From the batteries, an inverter provides power to all the electronics. The installation only operates at night and the PV panels and batteries will be sized so that the installation will have sufficient power for each night. A backup ultraquiet generator will provide power if not enough sun is available to charge the batteries. The artist has used solar power on the playa for 7 years, and was responsible for the power grid for Xara in 2001 and 2002, so designing this power system will be easy.

There are 64 LED Control boards and 9 Director boards in each tree that form a branched network used to control the color of the leaves. The three trees plug into a USB Root Router board that is the interface between the trees and a laptop computer. The electronics operates at 3.3V and each LED board has special circuitry that maintains constant current for driving the LEDs. Prototypes of the LED board are completed and the electronic circuitry design for the other two boards is complete, awaiting fabrication and assembly.

The majority of this project will be software. Basic system functionality will be achieved relatively quickly, but USB connectivity and the Advanced Control Modules will require much work. The plan is to make as many ACMs as possible before the event and push to the "amazing" realm as much as we can. I've been a professional electronics engineer for 28 years and have contacts that can help with development. There are also ongoing discussions with Lindsey Lawlor (The Electric Giraffe) and Gary Stadler (Inner Mind, etc) and Henry Chang (Soul in the Machine) about cross-development possibilities.
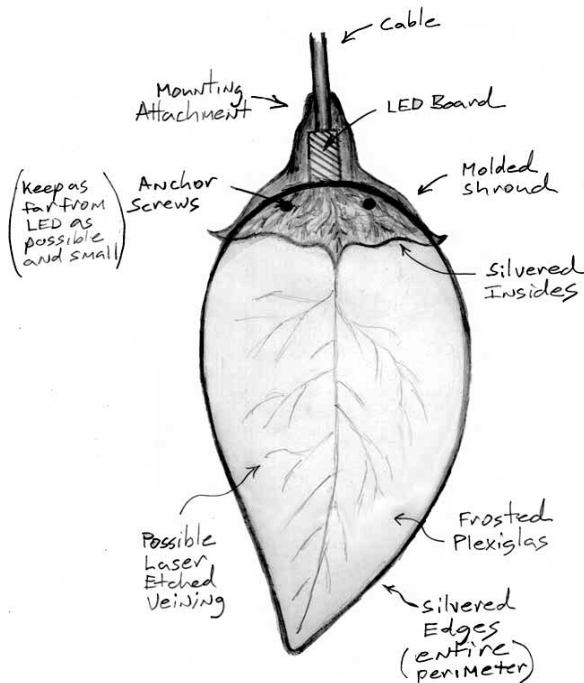
Each leaf is 8.5" long and 5" wide. The leaves are made of 3/8" thick frosted Plexiglas with laser etched veins, giving the leaf a natural look. The edges are coated so that most of the light comes out the faces. The LED board fits into holes at one end, and fills the Plexiglas with light. A shroud covers the LED board to contain and direct light, and to also provide a way of attaching the metal tubing that supports the leaf. Each leaf attaches to the bamboo support structure via the metal tube so that wiring is completely hidden inside the tube and bamboo. The metal tubing can be bent to create an organic aesthetic. The shroud and tubing will be painted to look like a real plant.
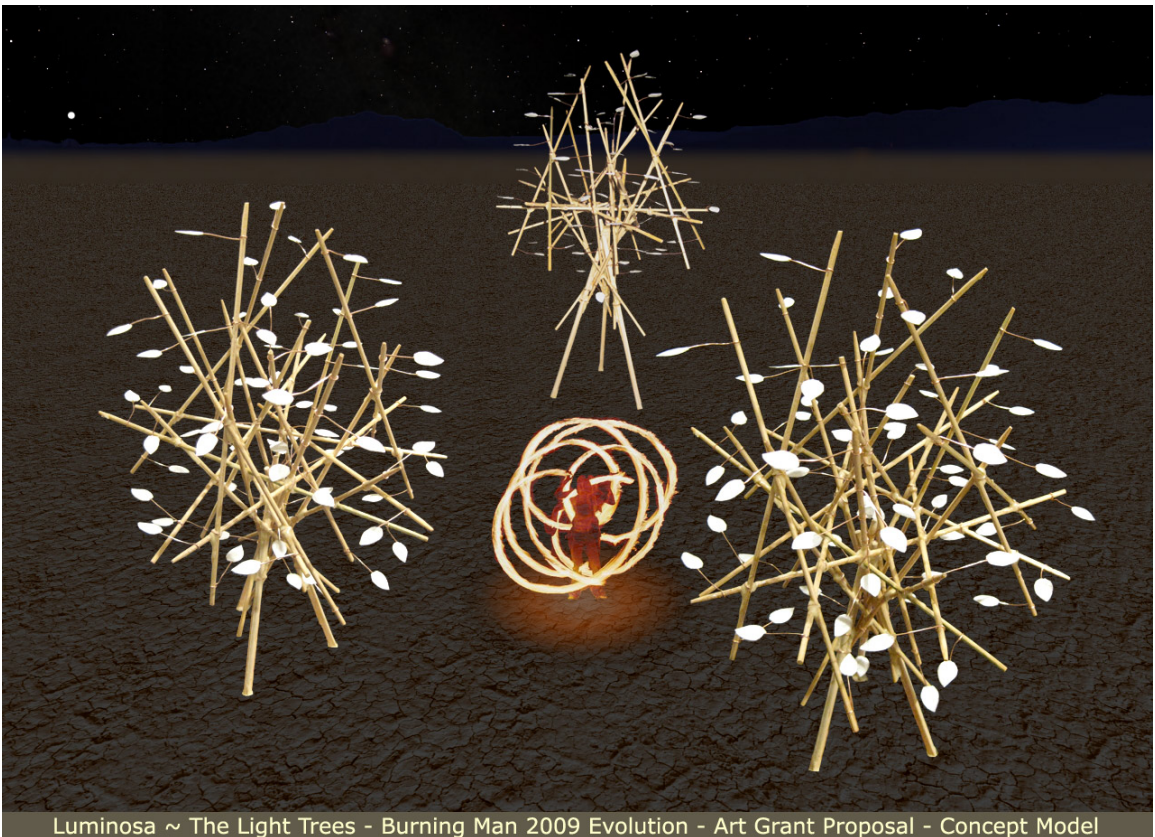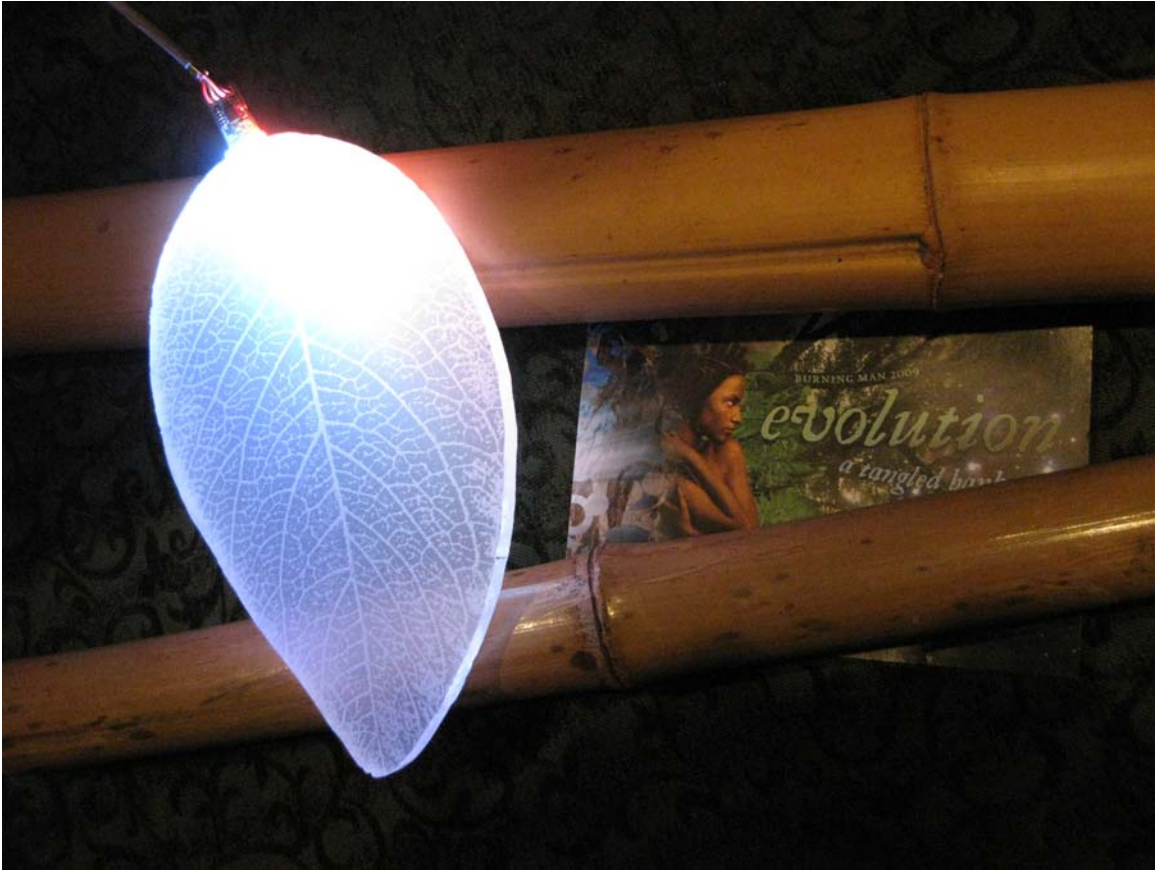
Luminosa ~ The Light Trees - Burning Man 2009 Evolution - Art Grant Proposal - Concept Model
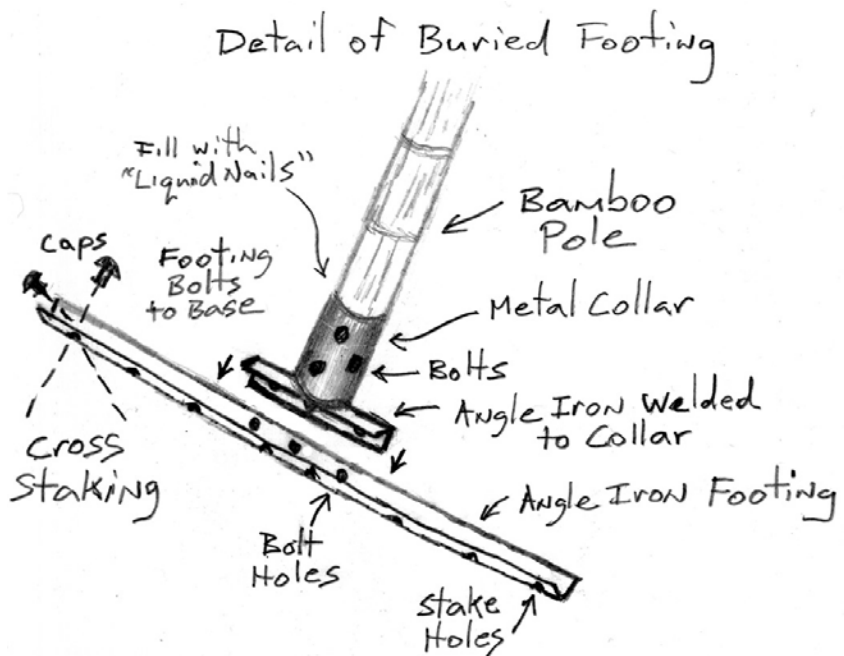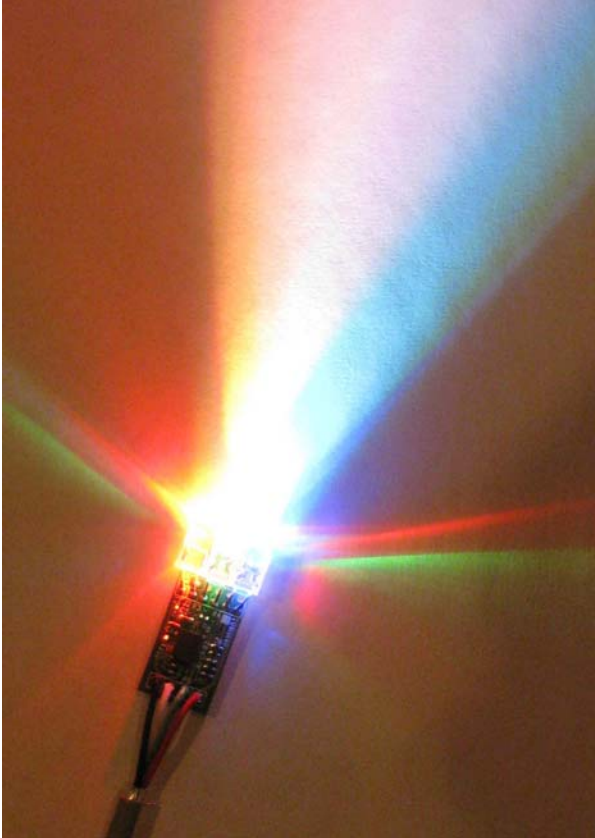
The tree structure is made of various diameter bamboo poles. Bamboo was chosen as the main building material because its our intention to use green building materials whenever possible. It is a renewable resource that is lightweight and has the strength of steel. A large supply suitable for this project has been located at a local wholesaler's warehouse (http://www.calibamboo.com).

Each bamboo tree has three 5"x10' poles, six 4"x10' poles, and fifteen 3"x10' poles. There are 2" poles used for detailing and a set of all size poles kept for emergency repairs. The poles are chosen to look as "organic" as possible for "Evolution".

The poles are attached together with bolts and metal collars. Each joint is lashed together with recycled bicycle inner tubes to give the tree strength and resilience.

The metal footing of each tree is designed to disassemble for easy handling and storage. The footing is buried so that only the top of the collar is visible. A long piece of iron angle iron is staked to the playa in the trench and the mating bracket of the leg is bolted to it. This forms a strong and solid base that will keep the tree firmly anchored, even in high winds.

Detail of Buried Footing

Fill with "Liquid Nails"

Caps

Footing Bolts to Base

Cross Staking

Bolt Holes

Stake Holes

Bamboo Pole

Metal Collar

Bolts

Angle Iron Welded to Collar

Angle Iron Footing

The custom LED board is capable of producing bright light of any color. A specialized control chip powers the individual red, green and blue LEDs, and is able to capable of producing very rapid and complex changes in the color of the light. Commands to the chip are sent over an I2C bus.

The Director board routes the I2C bus commands to each LED board. It is also the board that forms the physical network in each tree. Each LED board plugs into a Director board, which then plugs into either another Director board or the Root Router.

The Root Router board is the high speed USB device that interfaces the laptop to the I2C bus. All the Director boards within all the trees plug into the Root Router. The High Speed USB bus operates at 488 Mbits/sec.

All three boards are custom designs made specifically for the Light Trees. The prototypes of the LED board are finished. After receiving funding, full production of all three boards will be commence. The schedule for delivery of finished boards will correspond to software development, and testing needs.

The LED control board uses a programmable 3 channel LED control chip that has built-in current & voltage regulation. This allows precise control of the light. The chip is capable of running small programs it receives over the I2C bus. Once the program is stored, dynamic light patterns can be displayed without any further computer control. This is the most basic level of operation of the lighting technology and will be achieved quickly. Some very nice lighting effects can be displayed at this stage.
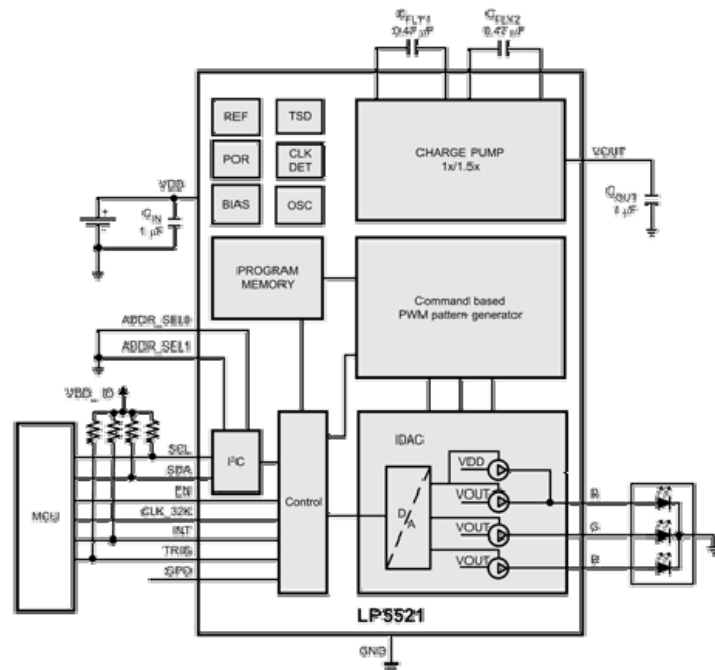
There are development tools available from the chip manufacturer that will be used the used to display simple light patterns in the trees. We will have some nice lighting effects very early in the software development phase. Once the software that sends commands to the leaves is complete, these tools will still be used to create individual lighting effects that the more sophisticated software arranges together to create even more elaborate sequences.
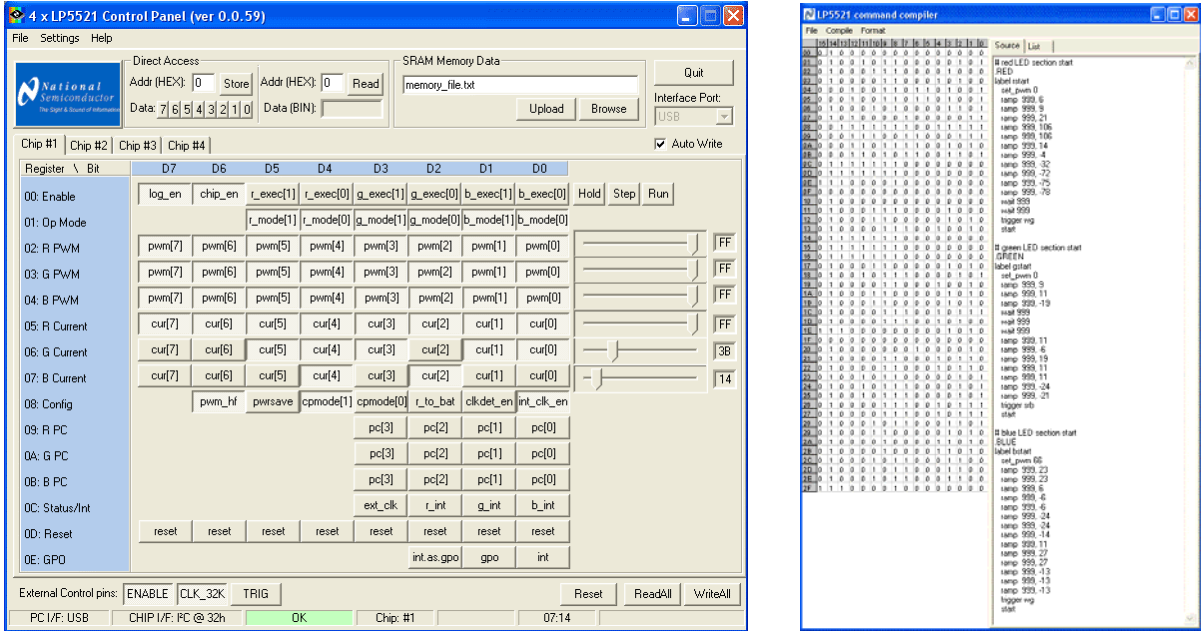
This first phase of software development creates the core technology for communication over the I2C bus to the LED boards. Next the artistic controls that create colors and patterns of light in each of the leaves will be developed.

The Advanced Control Modules are individual software applications that perform specific functions related to lighting effects. They make it possible to do all the fun and amazing things we would like to see the Light Trees do. The trees are organic sculptures that share the same 3D space and can be controlled in unison, making it possible to do some new and unique things.

ACM examples: synchronizing the lights to sound, displaying 3D patterns in the leaves, rotating and shifting light patterns in the leaves, creating pulsing/rippling/swirling effects, creating waves of light radiating through the leaves, creating shapes in the lights based on participants control, creating dynamic spatial interactions between the areas of lights, generating complex algorithm-based patterns, mapping video colors to the leaves in 3D space, mapping motion near the trees to color/pattern changes in the leaves, strange random lighting effects, light "smoke" blowing thru the trees, light raining down thru the trees, layered levels of changing color, pulsing light centered in each tree, orbs of light bouncing between trees. bright spots that follow people walking near the trees, simulated fire, anything else we can think of and do before the event.

The shed will large enough to hold all the equipment (batteries, power controls, backup generator, etc) and have room to operate a laptop and play music for special performances. The shed is designed to control dust and vent heat and exhaust. The backup generator is not expected to be used, but will be in a place within the shed that is fireproof for safety if it is used.

The shed will be made of recycled materials to lower costs and be ecologically responsible.
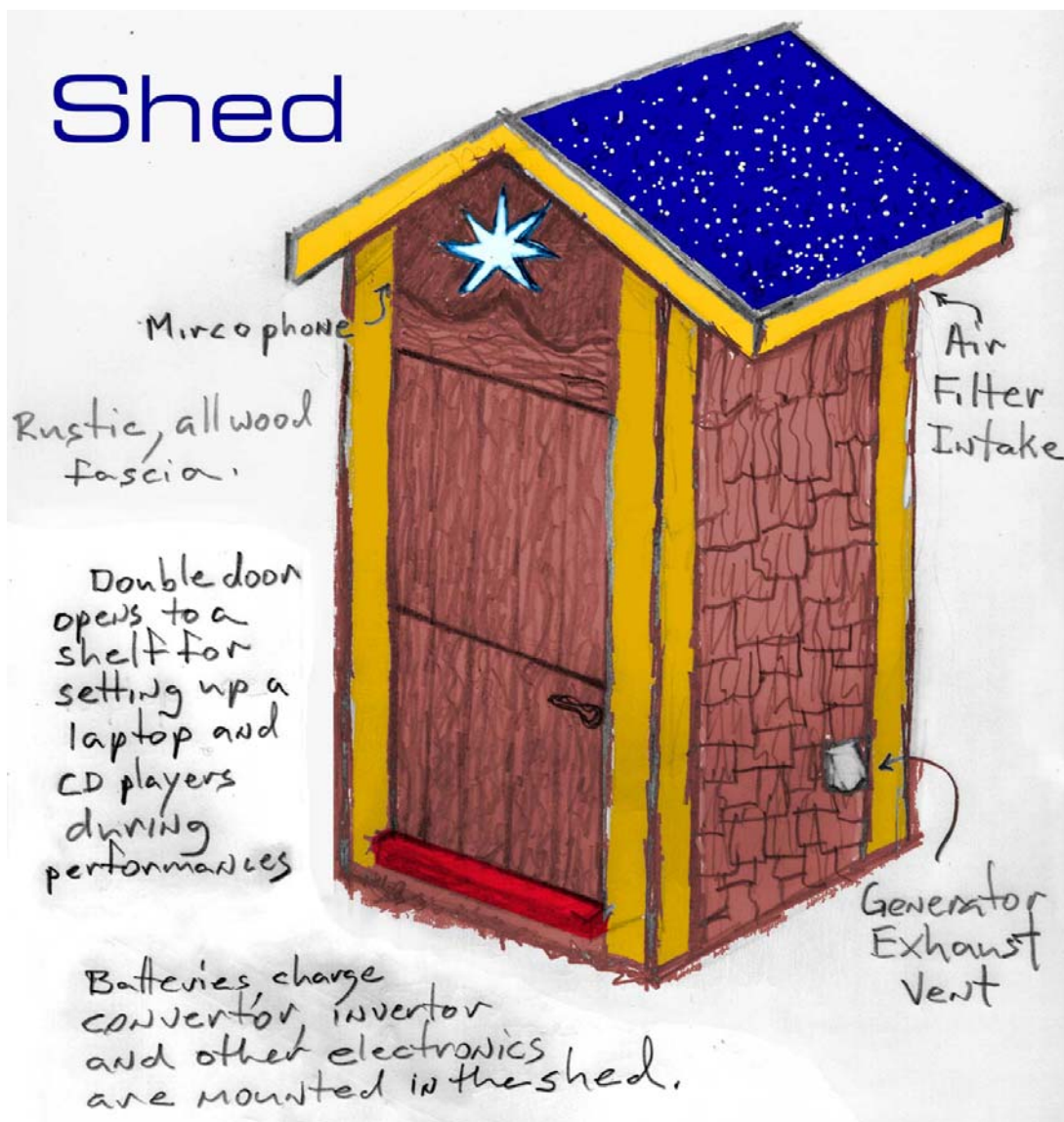
Crew List

A crew of 5 people is required to realize this project. Due to the complexity and magnitude of work required for this project, nearly all of the actual fabrication will be done off-playa before the event. This will be done by the Project Director and assistants. The Trees will be designed and fabricated so that easy disassembly, transportation and reassembly are possible.

This project will require tickets for five crew members.

On the playa, the crew will be:

Project Director:	**Bill Watson – Technical expert, construction coordinator and primary builder for installation.**
First Builder:	**Crew member with detailed training in constructing and assembling the Trees. Builder responsible for building support structures for the Trees.**
Second Builder:	**Crew member providing support for the construction of the installation. The essential third builder, and driver of the truck used to bring the Trees to the playa.**
Logistics Lead:	**Crew member responsible for establishing base camp and providing food and personal support for the crew. Also manages storage and transportation of materials.**
Assistant:	**Crew member assisting the Logistics Lead with base camp and other tasks that require additional help. Either the Assistant or the Logistics Lead will drive the second truck used to bring the crew and camp gear.**

Crew members are expected to be drawn from Devachan Lounge, an established camp on the playa. Bill Watson formed Devachan Lounge in 2003 after two years of serving as one of the primary builders of Xara. Original members camped with Xara in 2001 and Lady Shakara in 2002. We have camped together every year since 2003, and will be on the playa in 2009 for our seventh year. Each year the camp has about 28 people in it.

In 2007 for Green Man, Devachan Lounge had 55 members, a performance dome for live music, a camp kitchen, chill space, a public Arcoyoga practice area, an interactive "Kitty Dome", and was powered entirely by solar panels.

Previously Devachan Lounge has been a sanctuary and comfort camp for artists, musicians and fire performers. Some are now part of the Gamelan.

Project Timeline

Pre-Playa Timeline

Oct 1st	**Begin design of lighting technology for Trees.**
Nov 1st	**Create prototypes for Plexiglas leaves.**
Dec 1st	**Fabricate prototypes for LED control board.**
Jan 5th	**Test the LED board prototypes and integrate into leaves. The final design and test of the Leaf-LED is complete.**
Jan 15th	**Design and build model of The Light Trees sculpture.**
Jan 30th	**Submit proposal.**
Feb 2nd	**Begin development of basic lighting control software. Purchase development tools and USB development kit.**
Mar 1st	**Receive funding. Purchase bamboo materials needed.**
Mar 2nd	**Fabricate remaining electronics devices needed for the lighting and control of the illuminated Plexiglas leaves. Purchase all components for fab/assembly, plus wiring.**
April 15th	**Software / Hardware integration and test. Test all the electronics devices in the system. Test the core functionality of the software. Test the system as a whole.**
May 1st	**Begin development of the Advanced Lighting Control software. Continue expanding this technology until leaving for BRC.**
June 1st	**Begin fabricating the three Light Tree sculptures. Purchase Plexiglas and all hardware.**
July 15th	**Complete the three sculptures with electronics installed.**
Aug 1st	**Integrate all components together and test the lighting technology with fully built trees.**

On-Playa Timeline

Aug 22nd (Sat) — Pick up rental truck and begin packing.

Aug 25th (Tue) — Leave San Diego for BRC.

Aug 26th (Wed) — Arrive BRC and establish base camp. Get placement from The Artery. Build the shed and assemble the Tree bases.

Aug 27th (Thu) — Branches are installed on the Tree bases.

Aug 28th (Fri) — Dust storm kicks everyone's ass. Not much is done.

Aug 29th (Sat) — Final construction and detailing of all structures.

Aug 30th (Sun) — Site clean-up and final preparation. Testing of lighting.

Aug 31st (Mon) — Event begins and The Light Trees are illuminated!

Sept 1st – Sept 5th — Various performances and shows at the Trees.

Sept 6th (Sun) — Disassembly and packing of all structures.

Sept 7th (Mon) — Check-out with Artery, LNT site inspection and sign-off. Break camp, pack and leave BRC.

Sept 7th (Tue) — Stop, rest and regenerate. Dispose of trash.

Sept 8th (Wed) — Drive back to San Diego.

Clean-Up Plan and Exodus

Because the Trees are designed to be assembled and disassembled, clean-up is expected to be relatively quick and easy. One full day of work should be all that is required to have the Trees and additional structures back in the truck. The same crew that assembled the trees will do breakdown and clean-up.

Beginning disassembly on Sunday should give enough time to meet the Monday night exodus deadline. Each tree will be disassembled in sections and packed into the truck (we need to get DMV clearance to drive the truck to the installation site). The shed is designed to come apart in sections and will pack into the truck easily.

Buried wiring will be removed and the soil returned to a natural state.

The footings for the trees will be unstaked and removed. The iron footings for the trees will not contaminate or degrade the playa and the soil will be restored to its original condition after they are removed.

The crew will sweep for MOOP and restore any soil disturbed by the installation. There are no fluids or materials used that could contaminate the playa, so this is a non-issue. Any debris or contamination caused by the participants at Burning Man will be removed by the crew for this project.

The footprint of The Light Trees is very low impact, Clean-up will be easy.