PROGRESS REPORT

Terra Foundation, Open Source Ecology (OSE)

February 16, 2012

For Grant Number 20110738

Terra Foundation, Open Source Ecology

Project title: Building of the Global Village Construction Set

Budget

ITEM	COST
CNC Torch table, Prototype 2 & 3 to Product Release – featuring open source stepper motor controllers	$15k
CNC Multimachine – Prototype 1 that includes surface grinder, mill, drill, lathe, cold-cut saw, ball-bearing grinder, and nut-and-bolt machine.	$26k
CNC Circuit Mill, 3 prototypes to Product Release, based on SnapLock design	$3k
Ironworker Machine with metal shear element, Prototype 2	$7k
Dimensional Sawmill, prototypes 2&3, 5000 board-feet/person/day	$20k
Modern steam engine system for biomass-fueled power	$19k
Technical documentation: instructional videos, fabrication procedures, etc.	$10k
TOTAL	**$100k**

EXHIBIT C

Please prepare a report responding to the following (include grant number **20110738** on all reports):

1. Current status (progress update) of program/grant as described in your proposal, including a final report, documentation and instructional videos.
2. Problems or barriers experienced in carrying out the program as planned, **if any**, and steps taken to resolve these problems.
3. Changes made to your planned program approach, **if any**, since your prior report, and reasons for the changes.
4. Plans to sustain the program/initiative long term.
5. Major changes in leadership (board, staff, etc.,)
6. Any potential risks, e.g. financial challenges, etc.
7. Accounting of the use of funds in a format similar to the Budget Report below. Provide a brief explanation of any significant variances.

BUDGET REPORT

Date of Report: _____

Current Progress on Building of the Global Village Construction Set

CNC Torch Table – The build of Prototype II is currently in progress and is expected to be completed by Feb. 24. We recruited Ben Horton, custom fabricator working with our team, to build a copy of his CNC Torch Table design – a proven design with hundreds of hours of production run time – as the OSE CNC Torch Table Prototype II. This is an improvement over Prototype I from last year. He is also providing full CAD drawings. We are building a 6′x11′ foot structure to handle up to 5′x10′ sheets of metal. We need to work out the addition of automatic z height control, and we have secured an open source stepper motor controller from collaborator Darren Vandervort to replace the proprietary Gecko stepper motor driver. We will be using open source control code and controller with Prototype II. Prototype III will be based on test results from Prototype II. We expect a robust design which will be able to cut out complete tractor frames as the first real test of production capacity related to the GVCS.

CNC Multimachine – So far, we have secured 2 Bridgeport mills and a surface grinder to build out the CNC Multimachine. These machines are also being used to study the industry standards related to the CNC Multimachine. One of the Bridgeports will be converted to CNC in order to facilitate development of the CNC retrofit to the OSE Multimachine. The general design specification has been defined as a scalable, modular concrete block machine with precision drive modules attached to the blocks. The next step is the design of a sample lathe and mill configurations.

CNC Circuit Mill – Yoonseo Kang was assigned as project developer. Prototype I of the CNC Circuit Mill has been completed. A mini-lathe was secured to produce key components. The machine had several bugs that prevented it from being useful in circuit milling. Prototype II is now in progress to address these issues. See Yoonseo's documentation, build pictures, and video. We are using Pololu stepper motor drivers, but we are moving to higher power – using collaborator Darren Vandervort's open source driver. We will be evaluating this driver as a replacement for the Pololus as well as a replacement for the Gecko 540s that we are currently using on the CNC Torch Table.

Ironworker Machine – Brianna Kufa was assigned as the project leader. The design, bill of materials, and basic calculations are complete. See last blog post andIronworker Machine Proposal Brief. The build is currently being started in San Diego, Calfornia, and completed machine will be delivered to Factor e Farm upon completion. Roger Olson, collaborator from Tennessee, is currently helping us with open-source fabrication of hardened cutting blades for the Ironworker. Fabrication requires machining, hardening, and surface grinding. The hole punch, flat, and angle shear blades cost about $1400, so it is worthwhile to pursue blade fabrication. Assistance needed: help in a conversion of Sketchup into a professional CAD package to perform CAE analysis on predicted shearing and punching capacity.

Dimensional Sawmill – Prototype I will be complete by early next week after a long break, and will be field tested in early March. Jose Bravo, fabricator, is joining Factor e Farm in 2 weeks to build out Prototype II – based on test results from Prototype I.

Modern Steam Engine – Mark Norton is the Modern Steam Engine project leader. This project includes the engine proper, heat exchanger, and gasifier burner. A clear path to execution has been identified. Engine parts are ordered, heat exchange coil Prototype I is done, and gasifier burner design is complete. Gary Hadden, a member of the Steam Automobile Club of America, is offering

the world's only modern steam engine kit. We are using this as the platform for OSE's development of the modern steam engine – an 8 hp, double acting, poppet valve uniflow steam engine. The part kit will be ready for shipping by the end of this week. While in Michigan, I stopped at Tom Kimmel's Steam Automobile Club of America (SACA) headquarters – a leading information source on modern steam power. The Heat Exchager is part of the Modern Steam Engine. While at the SACA headquarters, we wound heat exchanger coils – a monotube steam generator. See the detailed 43 video clips on this process – including pressure testing to 3000 psi. This will be used to convert water – heated by a gasifier burner – into steam to run the steam engine. Welding pancake coils is not easy. However, it appears that we do not want to do pancake coils for pellet gasifier burners – our fuel choice for stationary and mobile power. According to Larry Dobson, below, pancake coils will be about half as efficient as helical coils when a superefficient gasifier burner is used. It turns out that helical coils are much easier to build than pancake coils, as all the welds in the associated tubing can be made while the tubing is straight – prior to coil winding. This saves a factor of approximately 4-8 times in terms of welding time required for helical coil production. We will build out collaborator Larry Dobson's high efficiency pellet fueled gasifier burner as the heat source for the modern steam engine.

Problems, Barriers, and Recovery Plans

Given that we are 2 months into the funding and 4 months remain – and that some prototypes have already been built or started - progress appears to be well on track. The CNC Multimachine is the least developed machine and it contains a large number of modules - so we will have to focus more directed effort on this machine to deliver results as promised. Our recovery plan is to either invite one or more machinists on site for a Dedicated Project Visit, or to recruit remote precision machining subject matter experts.

Changes

No changes have been made.

Plans to Sustain Program in the Long Term

We are going through a reorganization of Open Source Ecology by recruiting an Executive Director and Projects Director to provide the leadership and an increased level of rigor to our development method. Further, due to our growth, we are taking steps to incorporate our own non-profit instead of going through a fiscal sponsor. In the near term, we expect funding to come from non-profit resource development. In the long term, we aim to fund our work from training workshops and production earnings – based on the economic significance of our open source tools.

Changes in Leadership

We are currently recuiting an Executive Director and Project Directors.

Risk Assessment

CNC Torch Table – mechanical build is straightforward, as it's based on a proven design. There is a small level of risk in delivering the open source stepper motor controller, in that the system is in its first prototype stage. We are aiming for milling our own stepper motor controller, which would be the first open source, high current stepper motor driver – also usable with CNC Multimachine. Jose Bravo allocated to prototype II and III build.

CNC Multimachine – The basic build should of blocks and modules should be straightforward.

However, careful, replicable process for alignment will require skill and practice. High level of risk exists for ball-bearing grinder and screw machine, because these devices are complex, and may require allocation of additional resources.

CNC Circuit Mill – the mechanical/electric build is not difficult. The greatest risk comes from the software integration for a turnkey software solution to go from design files to finished circuit. Programming will be required, for which we will need to recruit further talent. Project Lead further needs to resolve Visa issues, which may take time from development.

Ironworker Machine – low risk due to completeness of design. No problems are expected regarding delivery.

Dimensional Sawmill – low risk, given proper control of blade speed. Hydraulic hose routing is the main issue to be resolved, but should not cause concern. Jose Bravo allocated to Prototype II and III build.

Modern Steam Engine – Complexity of integration may cause budget overrun if labor hours are excessive, unless we recruit volunteer machinists/fabricators. This is true because the project requires an integration of 3 GVCS tools – engine proper, heat exchanger, and gasifier burner. Additional funding will be allocated if needed.

Budget Report
Date of Report: Feb. 16, 2012

Category	**Kauffman Grant ($)**
Revenue	65,000
Expenses:	
CNC Torch Table	4,800
CNC Multimachine	5,500
CNC Circuit Mill	1,824
Ironworker Machine	6,414
Dimensional Sawmill	0
Modern Steam Engine	1,802
Total Expenses	20,340
Remaining Funds	44,660