Design Rationale

Definition: LifeTrac is a low-cost, multipurpose open source tractor. LifeTrac is a versatile, 4-wheel drive, full-sized, hydraulically-driven, skid-steering tractor of 18-75 hp with optional steel tracks. LifeTrac is intended to be a minimalist but high-performance, lifetime design, design-for-disassembly workhorse and power unit of any land stewardship operation. It features featuring easy serviceability by the user. Its modular nature allows for quick attachment of implements; interchangeability/stackability of multiple power units (Power Cubes) for adopting power level to the task at hand; quick attachment of all hydraulic components via quick-coupling hoses; including quick interchangeability of hydraulic motors for use in other applications. It can be fitted with up to two sets of loader arms. LifeTrac is intended to be used with modern steam engine Power Cube module for fuel flexibility, such that locally-harvested, pelletized biomass crop, such as hay, may be used for fuel. Regarding safety features, LifeTrac replaced the traditional power take-off (PTO) shaft for driving other implements with a detachable hydraulic motor for the same purpose, where this motor may be mounted on the tractor, on the implement, or wherever it is required.

Problem Statement – Industrial tractors are being designed increasingly for planned obsolescence with 10 year lifespans, and the user typically cannot service their own tractor due to complexity of design. Power transmission and engine systems are the dominant failure modes of tractors. Fuel costs are a significant expense of operating a tractor. Capital costs of purchasing tractors typically place their users in debt.

Solution – LifeTrac is designed to be the peoples' tractor. The user is able to service, modify, and produce fuel for the tractor. Gear transmission is replaced with a hydraulic drive train, where quick-connect, flexible hoses are the means of transferring power. Lifetime design (bolt-together construction, modularity) with general purpose parts allows the tractor to be passed down from generation to generation, before its life-cycle is completed as feedstock for the induction furnace. The absolute simplest design facilitates creation of small-scale enterprise for manufacturing these tractors in as little as 3 days of time using a RepLab1 facility. This allows communities to be entirely self-sufficient in their mechanical power infrastructures, while reducing lifetime costs of tractors by a factor of at least 10.

Development Status and Needs – We have completed Prototype I-III, and we are currently on Prototype IV. Prototype I (ref) was an articulated version of the tractor without roll cage, and Prototype II (ref) was an enclosed version with tracks and skid steering. Prototype II has demonstrated quick-attachment and stackability of power units (ref), as well as interchangeability of wheel motors and control valves via quick-couplers for repurposing in other applications. Prototype III was a shortened version of Prototype II with only one set of loader arms, and it featured CNC Torch Table assist in its fabrication. Prototype IV (Current as of Dec. 2011) introduces Quick Connect Wheels. Moreover, minor redesign (thicker wheel shafts and bearings (2.5" instead of 1-7/8") of LifeTrac lend themselves to adaptation as a tracked bulldozer – via addition of chain gear reduction to the direct-coupled wheel drive.

LifeTrac satisfies many of the OSE Core Values

Open Source: The LifeTrac was designed from the ground up with the intention of making freely available not only the design, but also the education necessary to understand, use, and improve the design.

Low Cost: As compared to its commercial equivalent, the LifeTrac is 1/5 of the cost to acquire. There are even more dramatic reductions in the cost to own.

Do-It-Yourself: Most of the components and sub-assemblies are held together with bolts. If you've got a wrench you've got a tractor.

Closed-Loop Manufacturing: Because the materials the LifeTrac is made out of require so little machining, they can be produced by future GVCS machines. No need for exotic materials or fancy injection molding.

Industrial Efficiency: The LifeTrac's performance is designed to be comparable to industry standards, and we are approaching that point quickly.

Lifetime Design: Unlike what is available commercially, the LifeTrac is designed to function indefinitely. Design for obsolescence is avoided, as maximum service to the user is part of the design.

Robustness: It ugly, but it works.

Technological Recursion: LifeTrac is part of technological recursion at the deepest level, in that it is responsible in part for extracting raw resources from which all things are made.

Local Resources: What good are the resources under your feet if you can't use them? The LifeTrac opens up new avenues for self-sourcing.

Replicability: With full documentation of how to source the materials, build the tractor, and use it in the field, the LifeTrac eradicates barriers to entry.

Product Ecology

From	Uses	Creates	Enables
▪ Power Cube	▪ Power Cube		▪ CEB Press
▪ Hydraulic Motor			▪ Rototiller
▪ Induction Furnace Steel			▪ Backhoe
Components			▪ Universal Rotor
			▪ Well-Drilling Rig
			▪ Trencher
			▪ Baler
			▪ Seeder
			▪ Spader
			▪ Rototiller
			▪ Hay Rake
			▪ Hay Cutter