Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)

Project Title: Online Simulation of Water Quality and Mining

ENRTF ID: 129-F

Topic Area: F. Outreach/Education/Training

Total Project Budget: $ 101,280

Proposed Project Time Period for the Funding Requested: 1 yr, July 2013 - June 2014

Other Non-State Funds: $ 0

Summary:

An online picture-based System Dynamics model spanning all watersheds for 400 years will be created from the mental models of Miners, Environmentalists, Native Americans, Regulators, Property Owners, and Investors.

Name: Sue Spencer

Sponsoring Organization: AI Consultants

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Web Address http://www.forio.com

Location

Region: Statewide

County Name: Statewide

City / Township: Ely

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ Employment	_____ TOTAL _____%

Environment and Natural Resources Trust Fund (ENRTF) 2012-2013 Main Proposal

PROJECT TITLE: Online Simulation of Mining and Water Quality

I. PROJECT STATEMENT

Here in Northern MN we are concerned that the mines will not open soon enough, and that the water quality for North America is at risk due to acid rock drainage (ARD). I've heard miners say, "Throw the environmentalists under the bus", and the environmentalists say, "Let's shoot all the miners." Neither side is listening to the other. There are many excellent scientists working on this, each in their own area, without really understanding the work of other experts. There are solutions that have never been tried, that could prevent ARD. The behaviors of Acid Rock Drainage (ARD) and Return on Investment (ROI) are determined by feedback loops so are non-linear, and hard to predict. It is essential to get experience over the long term without doing damage. Usually in feedback-driven systems, policies to improve behavior have the opposite effect. It would be better to make mistakes and gain insight on a simulation model than the environment.

There are already many simulation models on parts of this, but no one has looked at the System Dynamics, considering socio-economic variables over the long term and a broad area. System Dynamics excels at modeling feedback loops and social variables. For example, love has no unit of measurement, yet can be numerically represented in a model and be a powerful force. The time horizon will be 400 years, as this is the design parameter for new dams taking into consideration weather modification. The area to be considered will be all the watersheds effected by Northern MN mining activities. This will be online, open to the public, with a longer time horizon and over a broader area. The model output will be images as well as graphs, with the underlying equations available for inspection. The scientific papers the equations are based on will be linked to the table functions that produce the graphs and images. The goal is to see what can happen over a long time horizon to the social structure and economics of the area, make assumptions of experts transparent to other experts, and share knowledge.

I hope to replace anger with understanding for the good of the whole. It is through experience that behavior changes. That experience can come from a simulation model. Feelings are changed when a paradigm shift occurs. Give a person total control of the system, with real policy levers, in a model that is causally-based. Let them make decisions that affect future generations, and see the consequences. If tthe results are unintended, the user's mental model is challenged, or the computer model is wrong. The user can go into the model structure to find out why. There will be a way to log challenges to the model, and insights gained from the model online. The model will be improved, and users' mental models will be improved. Better mental models mean more understanding and better decisions.

The model will be built for 5th and 6th graders to understand, yet will be used by a broad range of people: general contractors building containment structures, County Commissioners allocating funding for related projects, even the MPCA to investigate the effects of granting variances. The average citizen will enjoy trying to make more money in the model, wreck the environment, initiate earthquakes, floods, leaks and wars, just to see what happens. Colorful characters from the future will deliver water quality reports. With water quality compromised, the web of life can be seen to change everywhere water goes from Northern MN: Hudson Bay, Gulf of Mexico, and the Atlantic Ocean. Science will have an entertaining interface for non-scientists.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Establish developer environment, graphics **Budget:** $28957

Outcome	Completion Date
1. Research and ID Participants, Send Confirmation Letter for Workshop October 23 and 24.	08/22/13
2. Splash Screen and Narrator characters for the years 2015, 2020, 2025, 2030, 2045, 2060, 2075, 2090, 2105, 2155, 2205, 2255, 2305, 2355, 2405	09/16/13
3. MN Watershed animation	10/14/13

4. Steering Committee Review	10/15/13

Activity 2: Interviews, Initial Mapping, Workshop to Gather Knowledge **Budget:** $40325

From each stakeholder group: Miners, Investors, Environmentalists, Regulators, Native Americans, Property Owners with the power to control mining or water quality in MN, identify three champions of that group's mental models, one of them meets for a two-day Ely workshop to map out building a System Dynamics Model.

Outcome	Completion Date
1. Interview 6 Workshop Participants, read background material	*10/15/13*
2. Workshop begins: Identify Issues	*10/23/13*
3. Identify Variables and Behavior Charts, Causal Loop Diagram: Straw Man Map	*10/24/13*
4. Report by Lead	*10/25/13*
5. Review by Steering Team	*10/28/13*

Activity 3: Workshop participants have homework, conference calls, then Webinars to Develop Dynamic Understanding **Budget:** $39289

Outcome	Completion Date
1. Stocks and Flows Diagram	*10/31/13*
2. Write model equations	*11/05/13*
3. Reference mode replication	*11/07/13*
4. Webiner: Policy and Strategy Testing, Report by Lead, 6 people, Steering Review	*11/12/13*
5. Review by Steering Team, written report by Lead and 6 people	*12/10/13*

Activity 4: Online Implementation Enacting Change **Budget:** $28897

Outcome	Completion Date
1. Port equations to Forio, Create online feedback forum	02/04/14
2. For Each Workshop Participant, identify in their group Influencers with ability to ACT: Future Leaders, Informal Thought Leaders, Connectors, Salespeople, Modelers from stakeholder groups	2/12/14
3. Six Sessions of 2 Hours each running the model via Skype with Lead for each of the 6 workshop participant and their Influencers	3/18/14
4. Each Influencer introduces online model to their stakeholder group	03/19/14

Activity 5: Online Implementing Model Change Requests **Budget:** $1930

Outcome	Completion Date
1. Implement change requests, with History of Causal Loop Diagrams and Stock-Flow Diagrams in Flickr	05/15/14
2. Influencers and their stakeholders receive email update notice	05/15/14
3. Tweets to Model Change Makers	05/15/14
4. Podcast of Model Use and Paradigm Shift	05/16/14

NOTE: Three additional pages provided beyond the limit were removed.

2012-2013 Detailed Project Budget

IV. TOTAL ENRTF REQUEST BUDGET *1* year

BUDGET ITEM *(See list of Eligible and Non-Eligible Costs, p. 11)*	**AMOUNT**
Lead: Sue Spencer, Owner, AI Consultants: Activity 1: 60 days; Activity 2: 37 days; Activity 3: 30 days, Activity 4: 45 days: total 172 days	$ 70,240
Process Facilitator: Chris Soderquist, Owner, Pontifex Consulting. $1500/day, Activity 2: 2.5 days; Activity 3: 5.5 days, coaching 3 days	$ 16,500
Forio Implimentation Facilitator: $1500/day, 5 days	$ 7,500
Steering Committee: Lucinda Johnson	$ 680
Steering Committee: Richard Watson	$ 680
Steering Committee: Nancy Schuldt	$ 680
Equipment/Tools/Supplies – Software	$ -
Simulate™*:* Online models	$ 500
Adobe Photoshop and Adobe Acrobat Package	$ 1,200
Google Earth Pro	$ 400
Adobe Flash Professional	$ 700
Stella: model development tools	$ 1,900
Travel: Sue Spencer picks up and returns Chris Soderquist MSP	$ 300
	$ 101,280

V. OTHER FUNDS

SOURCE OF FUNDS	**AMOUNT**	**Status**
In-kind Services During Project Period: Heart of the Continent Members will be exercising the model in person to gain insights and give criticism: 10 hrs	$ 800	requested
Funding History*:* none	$ -	NA

Sue Spencer

AI Consultants

Ely, MN 55731

218.235.9049 spencer.aic@gmail.com

Profile

Currently developing iPhone apps, one in the iTunes store: InsultAlarm, two in the pipeline. Original Design Manufacturer of Software for Fortune 500 including Apple, IBM, and Prudential. Degree from Dartmouth in Engineering Sciences, (System Simulation and Policy Design), a decade experience in Silicon Valley as a Knowledge Engineer (Artificial Intelligence). Delivered product in 10 operating systems, 10 languages. Written 7 books, a course in Expert Systems, created three wedding DVDs, and worked on Cable TV production crew. Founded a software company and did programming for ten years in Silicon Valley. Just finished managing $650K building project. Shipped 12 software programs, got PC Product of the Year, Technical Excellence Award from COMDEX. Currently designing a generic iPhone app to connect kids to nature and bring in tourism to the towns along the Canadian-US border lakes.

Skills Summary

Software Specification	System Dynamics	Script Object-Oriented Library
User Interface Design	Statistics	Computer Programming
Multi-Platform Delivery	Data Analysis	Project Management
Artificial Intelligence	Simulation Modeling	Professional Presentations
Creativity	Grit	Common Sense

Computer Skills

Basic, Fortran, Lisp, Pascal, C	SPSS, DOS batch files, XCODE,	Script Object-Oriented Library
Objective-C, Dynamo, HyperTalk	Oracle 3.0, Photoshop 3.0	OSX, Unix, DTSS, Apple II, Lisa
Windows 95/98/2000/XT/Vista	Google Sites, Docs, Cal, iPhoto	iOS, MacProject, HP Scan
Art, KEE, Aion, GURU, Nexpert	Conference Call recording, iDVD	Microsoft Office, iLife, LiveCode,
Insight+, Exsys, Expert Ease	Adobe Premier, Illustrator, iMovie	HyperCard & CAD drawing tools

Professional Experience

SYSTEM DYNAMICS MODELS

Managed a team of 10 programmers for the New England Sustainable Energy Project (NESEP), with sectors on renewable energy, the price of oil, wood, and conservation measures at the Resource Policy Center under the direction of Dennis Meadows. The goal of NESEP was to reduce dependence on foreign oil and to provide policy makers with a tool to investigate tax cuts, conservation measures, and fluctuation of oil prices.

Consulted on a Construction cost containment model for a foreign doctoral candidate and Construction Professional.

Designed and published a global warming model for the International Institute of Applied Systems Analysis (IIASA) under Donnella Meadows.

Designed and delivered a forest management model for the USFS Forest Products Research Lab under Dennis Meadows.

Developed a Just-In-Time manufacturing model for Boise Cascade for Peter Buttner, Brattleboro, Vt.