Reneal International Education Outreach Incorporated

2014 Tanzania Project Plan

January 2014

Contents

1. PLAN SUMMARY

Reneal International Education Outreach (Reneal IEO) installs low-cost computer labs at schools in the Philippines and Tanzania. In coordination with the Arusha District Council and other government officials, seven schools in Tanzania (Africa) were identified as candidates for 2014 projects. These schools were evaluated via on-site visits in August and September of 2013, and three schools were judged to meet Reneal IEO criteria for project involvement. A fourth school also appears promising, if time and resources permit.

The Reneal IEO mission statement is provided in Section 2. Section 3 includes a complete project description. All three schools are asked to agree to the expectations outlined in Section 4.

2. RENEAL INTERNATIONAL EDUCATION OUTREACH MISSION STATEMENT

Our purpose:

The paradox in many developing countries is that education is the path to improve lives, but schools are underfunded and many young people can't afford to attend. The specific purpose of Reneal International Education Outreach (Reneal IEO) is to provide support for students, their parents, teachers, and school administrators to enhance education opportunities in schools in developing countries. Recognizing the power of technology in particular to change lives, the primary focus of this organization is to provide Information Technology expertise and assets (computer hardware, computer software, and learning resources) to these schools.

What we do:

Our goal is to give students and teachers in developing countries better resources for learning. Key Reneal IEO activities are:

- Developing and installing low-cost computer systems for schools
- Developing the Philippines School Information System (SIS)
- Providing teacher training in IT
- Serving as a conduit to get educational materials to schools
- Providing funding for scholarships and microfinance programs

How we do it:

To support these activities, Reneal IEO will:

- Develop hardware and software solutions and associated trainings that are tailored for developing countries
- Freely share these solutions and trainings with other individuals, agencies, and corporations
- Perform on-site installation, consultation, and training in developing countries
- Capitalize on connections and cultural skills built through the founders' United States Peace Corps experiences
- Leverage multiple decades of experience in software and technology
- Seek corporate support for projects and provide tax deductions for donations

Why we do it:

Information Technology has the potential to ignite the love of learning in students and teachers and to open doors for new opportunities for those in developing countries. We wish to share our passion for IT with others in order to help them achieve a better life. The ultimate reward is seeing the spark in someone's eyes as they realize this potential themselves.

3. PROJECT DESCRIPTION

3.1. Beneficiary Organizations

Seven candidate schools in Tanzania (Africa) were identified in coordination with the Arusha District Council and other government officials. These schools were evaluated via on-site visits in September of 2013, and three schools were judged to meet Reneal IEO criteria for project involvement. A fourth school also appears promising, if time and resources permit. A summary of the evaluation criteria as well as the selected schools is included in Appendix A.

3.2. Technical Details

The Reneal IEO low-cost computer infrastructure was initially developed to support a high school in the Philippines. This approach allows a school to connect many (10-20) less powerful computers ("clients") to a single powerful computer (the "server"). Each of the clients looks like a capable unit to the user, but programs are actually running on the server. More powerful clients allow for local load-sharing as well.

Key features of the Reneal IEO low-cost computer infrastructure include the following:

- Centralized file storage and management
- Use of a client/server architecture
- Use of Open Source software (Linux, Libre Office, other applications)
- Integrated software environment, customized for secondary schools

A description of the advantages of this approach and details of the software environment are provided in Appendix B.

The original implementation of the Reneal IEO low-cost computer infrastructure used much less capable machines as clients (Pentium 1 and Pentium 2 desktop computers). However experience has demonstrated that there are significant advantages of acquiring more capable used equipment from a single source:

- Supported by newer versions of the Xubuntu operating system
- Sufficient power to run selected applications locally, reducing server load
- Can have other operating system present for stand-alone operation
- Homogeneity greatly speeds lab set-up

3.3. System Design

A comprehensive list of items required to stand up each of the three laboratories is summarized in Figure 1. Donated computers (laptops or desktops) are denoted as "Computer, Client" in the figure. Total costs are shown for 15 seats. A "seat" consists of either a laptop or desktop computer. Laptops have already been donated and are ready for use for the 2014 Tanzania projects.

Reneal IEO will supply all other project hardware as listed in the "Project Funding" column in Figure 1. The main expense is the server, which requires a multi-core processor, a large amount of RAM, two high capacity hard disks, and two Gigabit network cards. Servers are typically custom built and the software image is then copied to the disk. Donated laptops will also require one mouse per seat. A network switch is required for connectivity between the server and clients; the IT teachers are trained to fabricate Ethernet cables to reduce cost and to give maximum flexibility for room set-up. It is also essential to provide voltage regulation and surge suppression for the server, all clients, and the network switches due to variations in power that are sometimes experienced. The costs for shipping from the US to Tanzania are still being

researched. The estimate shown here (highlighted in yellow) is based upon six boxes shipped as excess airline luggage.

Beneficiary schools are expected to provide space and security for the IT lab, as well as tables for the computers and chairs for users. Optional items that have been proven to be useful to schools (a projector or large refurbished TV for projection, a printer, and cooling) are also included but shaded in gray.

Figure 1: IT Laboratory Items (15 seats)

Item	Unit Cost	Quantity	Total Cost	Reneal IEO Funding	Local Funding
Computer, Server	500	1	500	*500*	
Monitor	95	1	95	*95*	
Laptop, Client		15		*DONATED*	
Mouse	5	16	80	*80*	
Keyboard	7	1	7	*7*	
24 port Gigabit switch	100	1	100	*100*	
Uninterruptible power supply (UPS), Server	115	1	115	*115*	
Power Strip, Clients	10	6	60	*60*	
Cat 5e cable (300')	115	1	115	*115*	
RJ45 connectors	10	1	10	*10*	
USB Flash Drive	18	1	18	*18*	
SHIPPING: Tanzania	100	6	600	*600*	
Computer Table	15	8	120		*120*
Computer Chair	5	16	80		*80*
Lab Security (window grills, locks)	100	1	100		*100*
Printer	100	1	100		*100*
Big Screen TV	60	1	60		*60*
Computer-to-TV cable/adapter	40	1	40		*40*
Room fan	20	1	20		*20*
TOTALS			**2220**	***1700***	***520***

4. EXPECTATIONS

Beneficiary schools are expected to provide space and security for the IT lab, as well as tables for the computers and chairs for users. Optional items that have been proven to be useful to schools (a projector or large refurbished TV for projection, a printer, and cooling) are also suggested if not already available; these are highlighted in gray. Beneficiary schools are also expected to provide resources for maintenance and for expendable items as needed.

IT coordinators at the beneficiary schools will be expected to spend time with Reneal IEO volunteers to learn about the system and to assist with teacher trainings. Training sessions will be provided by Reneal IEO for teachers at the selected schools. These trainings will be scheduled in cooperation with the school heads to minimize disruption to classes.

School heads and IT coordinators at the schools will be expected to commit to use of Open Source software with the installed system. Installation of pirated software on any computer hardware provided by Reneal IEO is strictly prohibited. However software that is already installed on existing computers does not have to be erased and can be used in dual boot mode if desired.

It is expected that the computers provided by Reneal IEO will be used by students to learn about IT and for projects and research in other subject areas. It is expected that the computers will be used by teachers to prepare for classes, complete school reports, compute grades, and other school-related tasks. Because of limited Internet bandwidth, video streaming (even for educational purposes) is discouraged. Computers provided by Reneal IEO should be treated as a learning resource for students and teachers, not as an Internet café.

5. PROJECT MONITORING

Each of the selected schools will be asked to track two measures of success to monitor the project and evaluate its effectiveness. The first is computer usage rate in the IT lab. This will be tracked monthly by the IT coordinators. The second metric is based on teacher self-assessments of computer skills, conducted over time. This will be done by the IT coordinator in conjunction with Reneal IEO.

6. PROJECT RISKS AND MITIGATION

Below are listed the project risks:

- A key risk is hardware failure. The server is configured with two hard disks and daily backup so that single disk failure is not catastrophic. Clients can be removed or added to the configuration seamlessly in case of failure. However other hardware failures (e.g., a network switch) would be catastrophic, at least until they can be replaced during the Reneal IEO visit the following year.
- While provisions for security have been discussed with the schools, IT laboratory security is a concern. Site visits were encouraging in that a room dedicated to IT lab use was available. Laptops are advantageous in that they can be easily secured elsewhere.
- Reneal IEO experience has been that once computers arrive on campus, there will be intense competition for use, including IT classes for students, teacher administrative tasks, and use by teachers of all subject areas for research and teaching. A process must be in place for IT lab scheduling to minimize conflicts in use.
- The Linux user interface has been customized to look like Microsoft Windows®. However teachers that have some familiarity with Microsoft OS and applications will need to learn new skills. This risk will be mitigated by training sessions conducted by Reneal IEO for the teachers that will be done coincident with the installations.

7. ORGANIZATIONAL QUALIFICATIONS

Reneal IEO is a 501(c)(3) organization, incorporated in April of 2012. The co-founders have planned, designed, and executed multiple similar projects since they served as United States Peace Corps Volunteers in the Republic of the Philippines (2006-2008). The co-founders each have almost three decades of experience in technology-related fields. Brief background information is included as Appendix C. A history of their work is provided on the Reneal IEO website at http://reneal.org/content/history.

8. CONTACT INFORMATION

Reneal International Education Outreach Incorporated
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Reneal International Education Outreach Incorporated is a 501(c)(3) public charity. All donations are tax deductible to the full extent allowed by law.

APPENDIX A: BENEFICIARY SCHOOLS

For Reneal IEO computerization projects, the following criteria are used to determine suitability for a recipient organization:

- Basic infrastructure to support school computerization (e.g., secure space for computers, source of electricity, tables and chairs, internet desired but not required)
- A designated school Information Technology point-of-contact, such as an IT teacher or IT lab head
- Existing basic computer skills among the teacher population
- School is accessible from a main road with reasonable proximity to a city
- Potential to get internet
- Priority given to secondary school level
- Interested, enthusiastic principal, supportive parents and community
- A vision and passion for using IT in education

Schools for 2014 are listed in priority order for implementation.

1. Mwandet Secondary School, Arusha, Tanzania
Secondmaster: Supeet Ole Meinyal, +255-754-676599, supeetm@yahoo.com
1000 students
September 2013 site visit observations: Room is available with window grills (they would need to provide a heavy door). Roughly 6 km from main road, but they have a school vehicle. Most teachers know how to use the computer, and there are five teachers who would be able to help with teaching IT. No electricity but a 17 kW generator in a shelter with wiring around campus. School staff is very enthusiastic about getting computers for the students.

2. Ilkiding'a Secondary School, Arusha, Tanzania
Secondmaster: Jackson Grayson, +255-754-671387, jacksonmpinga@yahoo.com
IT Teacher: Bakari Kimath, +255-764-036010
1600 students
September 2013 site visit observations: Already have IT lab but most computers are very old units and not functional. There are bars on windows plus glass. Metal door with grill, place for lock. Wiring already in place but would need to redo Ethernet cabling. Have an IT teacher. Most teachers are familiar with computers. Public transport is available to school. School staff members are anxious to restart computer training for students.

3. Paroma Elementary School, Mara, Musoma, Tanzania
POC: Theobard Thadeo Kaiza, +255-767-573621, theobar@yahoo.com
Number of students unknown
August 2013 site visit observations: School with excellent prospects due to outstanding computer manager and available facilities. System already installed at nearby secondary school (2013 project).

[A fourth school, Kimnyaki Secondary School (Arusha), also appears promising if time and resources permit.]

APPENDIX B: SUMMARY OF RENEAL IEO LOW-COST COMPUTER APPROACH

Advantages of the server/client architecture and open source software environment:

- Easy maintenance – software is only on the server
- Clients can be added or removed easily
- Clients can be less capable computers (original implementation used obsolete P1/P2 machines as clients)
- Modular, extendable architecture: can run multiple servers in a large school
- Open source software is free, with no concerns about piracy
- No problems with viruses – this is a significant issue for schools
- All access to Internet is controlled through a single computer to provide filtering of content
- Users can access their own files from any computer
- Files are centralized for easy backup

Software is integrated and customized for a school environment:

- Internet filtering and caching
- Automatic backup
- Teachers
    - Individual password-protected accounts
    - Individual user profile information
    - Personal file storage space for each account
    - Shared file storage space for all teachers
- Students
    - Common look-and-feel for all student accounts
    - Folders for each student for individual file storage

Software elements:

- Linux Ubuntu operating system
    - Linux XFCE user interface created to look like Windows
- Libre Office (word processor, spreadsheet, presentations)
    - Can save/read Microsoft Office format
- Other standard applications (Mozilla Firefox and Google Chromium web browser, Adobe Reader, VLC movie viewer, Gimp photo editor, Bluefish web page design, CUPS printer manager)
- GCompris, TuxType, and TuxMath educational software

School resources configured for immediate use:

- WordPress blog
- School Wiki
- Moodle
- Squid internet filtering and caching with filters in place and set up for weekly update
- Internal Apache web server, home page with links to internal services and key external sites
- Firewall configured to protect all internal resources
- VPN for remote trouble-shooting and maintenance
- Prebuilt student and teacher accounts and file management structure
- Individual file storage area for each student
- Student accounts that can be created or replaced with a single command, to remove unwanted student changes
- Teaching and training resource repository

Complete documentation available at
http://reneal.org/sites/default/files/documents/ComputerInfrastructureForSchools.pdf

APPENDIX C: CO-FOUNDER CURRICULA VITAE

Neal R. Bierbaum, Reneal IEO Board President

Work Experience

April 2012 – Present, President and Full-time Volunteer for Reneal IEO
Continued projects in the Philippines and Tanzania.

January 2009 – April 2012, Full-Time Volunteer
Continued work in Philippines. Developed Philippines Student Information System, provided low-cost integrated software system to Aboitiz Foundation. Began work in Tanzania.

March 2006 – December 2008, United States Peace Corps Volunteer
Served as Volunteer at Compostela National High School, Compostela, Cebu, Philippines. Created low-cost distributed computer infrastructure on campus.

June 2001 – March 2006, Consultant - PACE, Inc.
Engineering consultant for Sandia National Laboratories. Developed simulation models of specialized network applications, a new network protocol, and remote high performance file systems. Designed and implemented major integrated multi-host software general test package.

September 1999 – February 2002, Consultant - PACE, Inc.
Continued consulting with Hybrid Networks. Performed significant redesign of numerous system elements for reliability and ease of use. Ported entire system to Solaris, Linux, and a new version of FreeBSD. Developed software architecture for Hybrid's next generation hardware.

May 1999 – August 1999, Transcontinental tandem bicycle ride with wife

October 1998 – May 1999, Consultant - PACE, Inc.
Chose to become consultant. Continued work with Hybrid Networks.

May 1995 – October 1998, Senior Engineer - Hybrid Networks
Primary engineer for "Head End" system. Designed and implemented all GUI Configuration, Monitoring, and Subscriber Database applications. Designed all control for 2-way cable system.

July 1991 – May 1995, Senior Engineer - Make Systems
Chief engineer for NetMaker Internetworking Simulation and Design tool. Created new conceptual model for simulation; personally designed and wrote all internetworking simulation software.

February 1989 – June 1991, Staff Engineer - Vitalink Communications
Senior software engineer in product engineering department. Developed software for wide area network bridge/routers. Created integrated software development environment.

September 1986 – January 1989, Systems Development Engineer - General Electric
Development engineer under contract to NASA Ames National Aeronautics Simulation (NAS) supercomputer center. Primary work in computer network communications.

June 1983 – August 1983, Transcontinental bicycle ride

August 1974 – June 1983, US Air Force
Commissioned officer (highest rank Captain). Experiences included instructing advanced students in the T-38 supersonic jet trainer and serving as C-130 Aircraft Commander.

Education

- Engineers' Degree Electrical Engineering, Stanford University, Stanford, CA, August 1986 (Thesis: "Space Station Experimental Control by a Remote Control Center". Same academic load as a Ph.D.)
- Master of Science in Electrical Engineering, Stanford University, Stanford, CA, December 1984
- Bachelor of Science in Electrical Engineering, US Air Force Academy , Colorado Springs, CO, June 1974 (double major in Electrical Engineering and Computer Science)

Rene L. Bierbaum, Reneal IEO Board Treasurer

Work Experience (Sandia National Laboratories, Livermore CA)

November 2013 – Present, Treasurer and Full-time Volunteer for Reneal IEO
Continued projects in the Philippines and Tanzania. Primary focus is on Reneal IEO operations and teacher training.

January 2009 – November 2013, Reliability Analyst, Reliability and Electrical Systems Department
Resumed career as reliability analyst following U.S. Peace Corps service. Received Individual 2012 Defense Programs Award of Excellence for work in surveillance metrics and sampling rationale.

March 2006 – December 2008, United States Peace Corps Volunteer
Served as Volunteer at Compostela National High School, Compostela, Cebu, Philippines. Conducted 41 training classes and modules for the teachers of CNHS and other municipal high schools, downloaded web resources for teachers, developed admin tools for teachers.

September 1999 – March 2006, Reliability Analyst, Reliability and Electrical Systems Department
Responsible for reliability analysis of various Sandia hardware and methodology development. Appointed Distinguished Member of Technical Staff (top 10% of technical staff) in 2000.

May 1999 – September 1999, Transcontinental Tandem Bicycle Ride with husband

January 1998 – May 1999, Reliability Analyst, Reliability and Electrical Systems Department
Because of desire to make greater technical contribution, returned to technical staff position following 5-1/2 years of management experience. Was responsible for reliability analysis of various Sandia hardware.

August 1992 – January 1998, Manager, Reliability and Electrical Systems Department
Managed a group of ten technical staff and a budget of approximately 3M$. Department mission included reliability analyses and use of electrical simulation tools to support Sandia products.

December 1988 – August 1992, Project Leader, Special Projects Department
Led multi-agency system integration effort involving system and component designers and production engineers. Responsible for liaison and requirements negotiation with external customers.

December 1986 – December 1988, Systems Analyst, Systems Studies Department
Developed computer software to analyze the effectiveness of various sensor technologies in tactical battlefield applications using high-resolution war gaming models.

June 1984 – December 1986, Electrical Engineer, Electronic Sensors Department
Part of a team responsible for developing an infrared imaging system. Specific tasks included acquiring and configuring test instrumentation and characterizing imaging system performance.

Education

- Master of Science in Electrical Engineering, Stanford University, Stanford, CA, June 1984.
- Bachelor of Science in Electrical Engineering, University of Nebraska, Lincoln, NE, May 1983 (also completed all requirements for a major in Mathematics, plus extensive coursework in chemical engineering and computer science)