

Clinical Experience in Rwanda Informs Student-Driven Design of Appropriate Technology



BIOMEDICAL ENGINEERING
TEXAS A & M UNIVERSITY

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Rwanda, Africa

- Tiny country in central Africa
- 1994 genocide
- Devastating effect
- Rwanda spent \$63 per capita in 2011 (US spent \$8,608)¹



¹ The World Bank, “Health Expenditure per Capita (current US\$),” <http://data.worldbank.org/indicator/SH.XPD.PCAP>

Summer Institute Programs

- In cooperation with Engineering World Health (EWH)
 - Nicaragua
 - Tanzania
 - Rwanda
- “Extreme Experiential Learning”
- 2-month program
 - 1 month learning culture, language, and technical skills
 - 1 month in hospitals



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Our Program in Rwanda

- Led by Dr. Kristen Maitland at Texas A&M University
- Newest Summer Institute program
- First A&M engineering study abroad program in Africa
- Grad students involved as TA's and/or participants
- Students can receive up to 6 hrs course credit
- Final Report: medical device design proposal

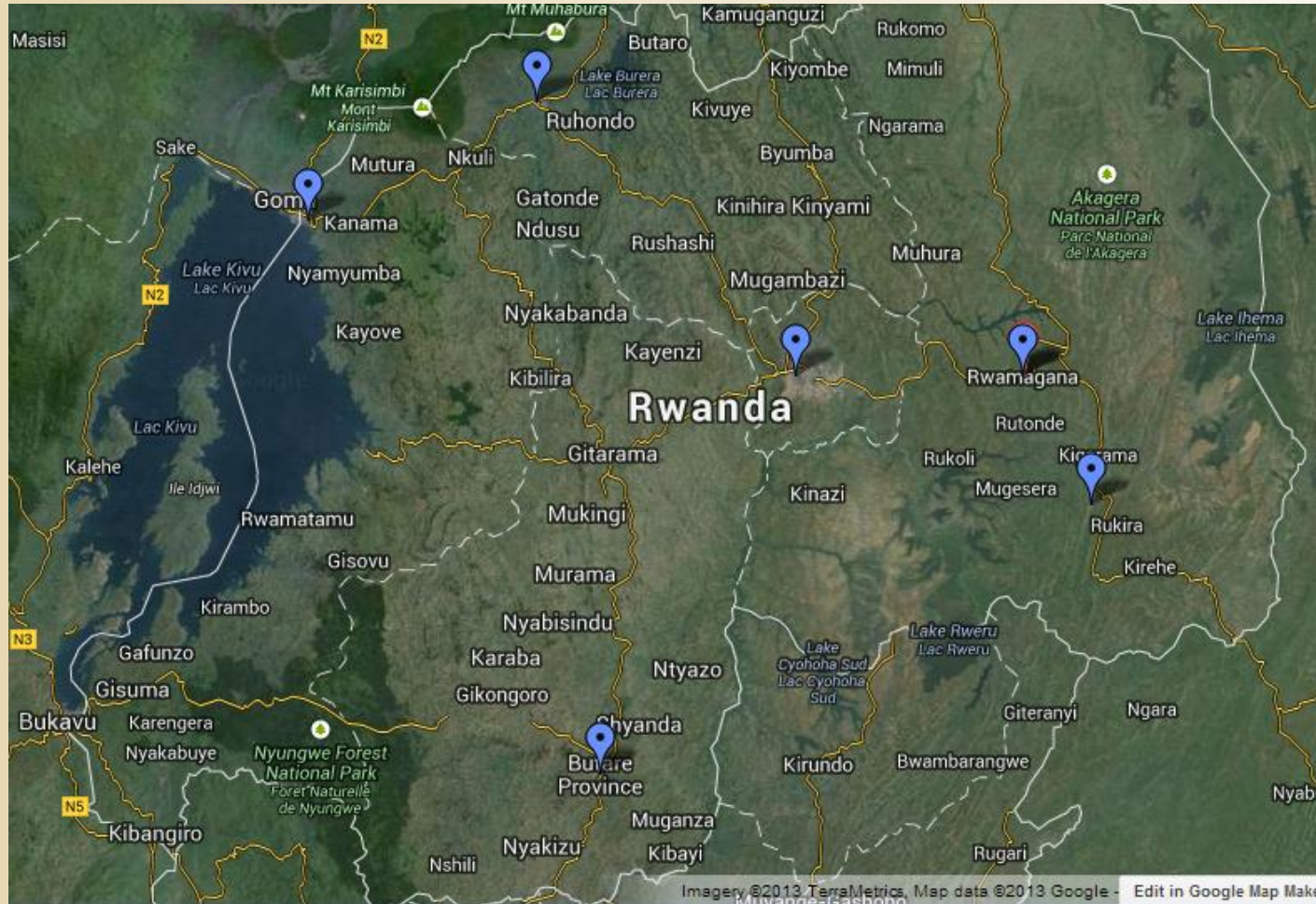


Inaugural Rwanda Summer Institute

- 13 students and 1 faculty instructor (Dr. Coté)
 - 10 engineering undergraduates
 - 8 BMEN, 1 ECEN, 1 CHEN
 - 3 graduate students
 - 2 BMEN, 1 PHYS
 - ***4 non-Texas A&M students***
- 6 hospitals, 6 design proposals
- 112 pieces of equipment repaired (~\$225,000)



Summer Institute Placements



What did we do in the hospitals?

- Repaired medical equipment
- Needs assessments
- Performed inventory
- Preventative maintenance
- Developed user guides
- Trained staff
- Secondary projects
- BMET shop renovations



My Assigned Hospital: CHUK

- Largest hospital in Rwanda (referral hospital)
 - 66 doctors (45 specialists)
 - 492 nurses/midwives
 - 128 general practitioners
 - 3 pharmacists
 - 104 administrators
 - 25 departments

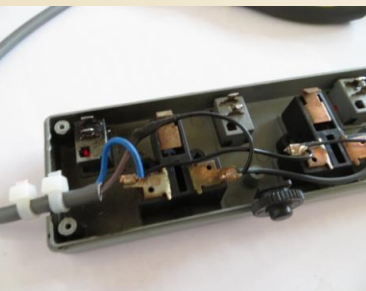
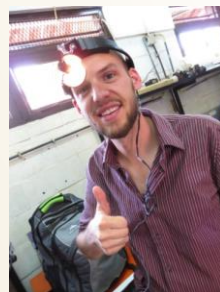


² Taken from Human Resources for Health Program information
<http://hrhconsortium.moh.gov.rw/about-hrh/program-overview/>



BMETs, Doctors, Nurses, & Americans!





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Repair Stats

- Total # of pieces of equipment touched: 34
- Total # returned to service: 29
- Abandonment: transformers and spare parts
- Source of problems:
 - Simple Electrical (17)
 - Power Supply (7)
 - Mechanical Simple (2)
 - Motor (1)
 - Other (7)

Repair Rate:
~85%



Needs Assessment

- CHUK has very impressive equipment
- Testing/diagnostic equipment is scarce
- Top 3 equipment needs
 - Electrical safety analyzer
 - Defibrillator tester
 - Incubator tester

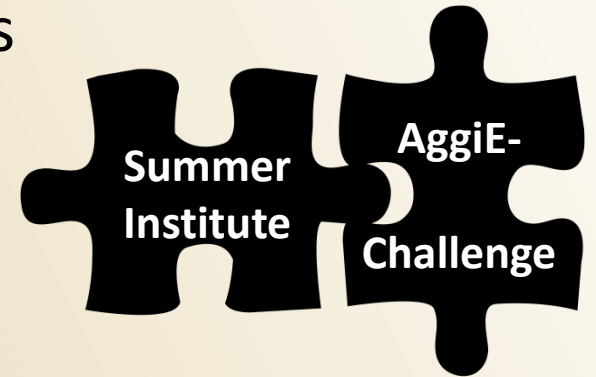


We don't want a Band-Aid solution...



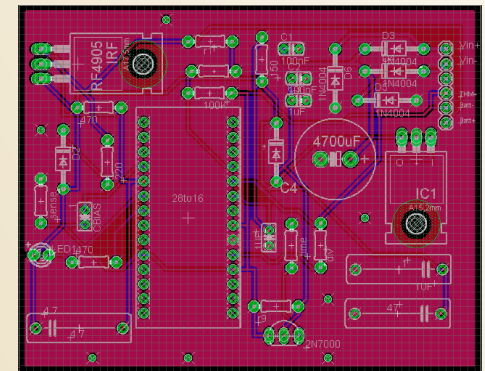
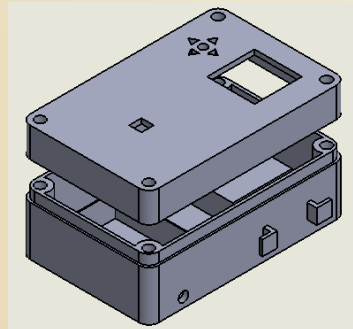
AggiE-Challenge Program

- Established in 2012 (Magda Lagoudas)
 - Promote multidisciplinary collaboration
 - Tackle grand engineering challenges
- Faculty-defined projects
- Teams are multidisciplinary and vertically integrated
- Faculty and graduate student mentors
- Students receive course credit (capstone project)
- In Fall 2013, there were ~150 student participants



Projects Relevant to Summer Institute

- Multi-Parameter Tester
 - Design proposal from 2 participants
- Stand-Alone Surgical Lamp
 - Worked on it before and after Summer Institute
- Point-of-Care Diagnostic Analyzer
 - Will be field-tested this summer
- Dr. Coté's NSF grant



Summary

- Summer Institute provides extreme experiential learning opportunity
- Participants develop deep understanding of user needs & environmental constraints
- Rwanda program leverages that experience through AggiE-Challenge
- Result is appropriate medical device designs
- Prototypes can be field-tested & re-designed



Funding Sources



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Weekend Trips



Top: (L) Akagera Safari; (M) Nyungwe Canopy Walk; (R) Musanze Weekend

Bottom: (L) Lake Kivu from Kibuye; (M) Hot Springs in Gisenyi; (R) Mt. Bisoke Volcano Hike



For More Information

- Program Info:

- <http://engineering.tamu.edu/international/studyabroad/locations/rwanda>

- (<http://goo.gl/dCihGL>)

- <http://www.ewh.org/si>

- Blog:

- <http://rittersinrwanda.wordpress.com>

- Brochures and Dr. Maitland's biz cards

