Mission Uganda Water 2018

Status Update and Goals for water supply and treatment in rural Uganda for the Mission: Uganda work August 2018

(For information on **Mission: Amazonas 2019**, see page 7)

Summary: In addition to its spiritual work, Mission Uganda has been involved in providing clean water to small communities in the Mityana District in Uganda since 2014. The work was founded on the work of Michael Ottensmann (then Northrop Grumman/USAF, now AECOM).

The August 2018 trip will focus on upgrading the sand filter with an automated mechanical backwash, upgrading the cascade sand filter, and refurbishing the solar salt chlorination systems, as needed, in the Mityana District. Implementing the solar thermal water system to combat water-borne pathogens not disinfected by chlorine at Zinga Island (Bussi Island in Lake Victoria). Scouting other villages for the sand filter/salt chlorination systems with the intent of building two, siting a second well, and scouting the New Covenant area for a future schlamm-dam. This year's trip will also provide an opportunity for mentoring eight students and three Jr. engineers.

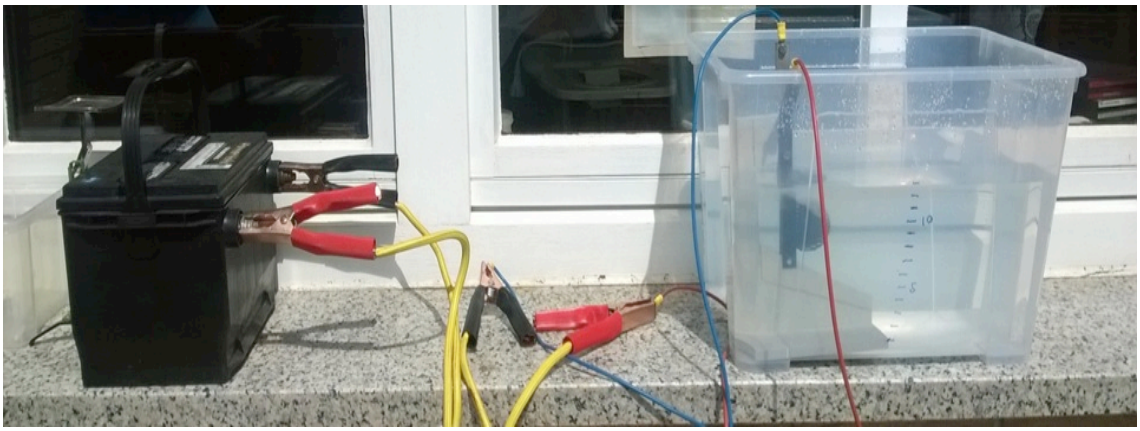
Status Update: To date, three annual trips have been undertaken, with a fourth planned for August 2018. The individual trip summaries are provided below. The primary concept is to break down known water treatment technology into its most basic form and adapt it to the local culture using the materials locally available. The Kymagamule Area, Mityana District in Uganda provided an excellent opportunity to develop the concept, not only from an engineering aspect, but it also afforded opportunities to field train young engineers and improve their real-life problem solving skills.

The Mission Uganda water program primarily works in remote rural villages having no utilities. Water supply is typically seepage water in ponds, highly turbid and contaminated with bacteria. Water is gathered with jerry cans in the morning and evening. The villages have less than 100 inhabitants.

Each year, the Lord provides a little bit differently. This year, we finally began to hear that the program was taking root in Kymagamule. In other years, it was often difficult to find enough hands to do the work. This year, the Lord has provided not only hands, but particularly skilled ones. I was working on a solar boiler idea to combat water-borne viruses, but I'm no solar expert. The next day at church, I was approached by someone who had heard of our work and wanted to join – a water heater specialist. I had heard about a plant that can reduce the incidence of malaria and wanted to try it, but I'm no botanist. The next day at work I received a call from

a young lady who works for us, who had heard of our work and wanted to join - her university degree was plant studies. I began to be concerned that I'd have too many hands for one man to handle and do effective engineering work. The next night at the Christian men's dinner, I was approached by a man my age. He had heard of our work and wanted to join – a senior engineer. And these are just a few of the many stories of our team this year.

Trip Histories: After the first trip, a simplified salt chlorination system was developed using electrodes and a car battery, similar to the science experiment we used to do as kids (splitting the water molecule into hydrogen and oxygen), only in this case, separating the sodium from the chloride in solution.



The prototype was tested by Ramstein HS students for simplicity and then implemented in the villages in Uganda. (https://youtu.be/-2VWFYjIHFo)

During implementation in Uganda, it was discovered that the turbidity of the water hindered the effectiveness of chlorine.

To combat the problem, a simplified rapid sand filter was developed in a PED water tank. In addition, a cascade sand filter was designed and built on the fly in two weeks on a local spring. Both systems are in daily use (last local report received Feb 2018).

For the upcoming trip (2018), building on the lessons learned in prior trips, a more simplified backwash system was developed (https://youtu.be/Xs7lxVwuaz8) for implementation. The filter systems in place will be upgraded and more built. The chlorination systems will be refurbished as necessary. Additional time will be spent with the villagers to ensure that usage is routine. Particular time will be spent with the local maintainer, providing additional training as needed.

More villages are slated to receive the chlorination/filtration system. At the request of a former AECOM intern, Ottensmann developed a relationship with a group working at a handicapped school and clinic on Zinga Island (See organizations list, Worldproject.ONG). The water at this location requires more than simple chlorine disinfection. Additionally, there are several other pathogens including schistomiasis, cryptosporidium, and a history of cholera. The SAME Water team has developed a prototype thermal system for field-testing to be implemented along with the chlorination/filtration system. It is also our goal to develop a relationship with a local Ugandan University to train local engineering students alongside our own.

One of the most rewarding part of the trips is the ministry opportunities. I've been allowed to teach from the pulpit on Sundays, which is always rewarding. But I think more important is how the faith is shared between cultures. It is a young Christian community, so there opportunity to teach, but their faith also has a strong impact on the members of my team. The *living* faith of the Ugandans, although they have very little, really impresses our team and deepens their own faith.

Key Team Members: All team members will take part in the sampling and engineering development in their own location.

Michael Ottensmann, PE (SAME) will be the overall team lead having senior responsibility for all engineering works. He will be the primary lead for the Mityana Project site.

Scott Vincent, PE (SAME) (tentative) will be the primary lead for the Zinga Project site.

Violeta Dimitresku will be the project lead for the upgrade of the cascade filter, as the project was based on her Masters Thesis.

Matthias Blauth is the primary solar designer for the project.

Karolin Woitke will be the primary engineer for the siting of a new well in Mityana. Although drilling a well is a more expensive alternative, during the last two years of drought, during the dry season, all the water holes dried up and the only water source was the sole water well in the area. Therefore, if funding is available, drilling a second water well at a safe distance is recommended. Siting is an essential part and often neglected.

Daniel Kaufmann will lead the constructability reviews.

Mahmud Uthman will have the project lead for sampling and water quality analysis to enable him to build on his experience as an environmental technician in that area. His technical skills in constructability will also be an essential part of the projects.

Isabel Trinidad Mendez Mora, University Grenada will lead the design for the solar thermal water treatment project as a part of her Master's thesis

Natalija Milanovich will perform investigative work. Her Bachelor's thesis will be on the construction of a facultative pond using papyrus as pre-treatment. One of the major issues in the drinking water source is contamination from wastewater sources. A facultative pond could be used to reduce the bacteria level released into the groundwater. Papyrus, because its root structure enables it to float, and grow in a wetland environment, could make it an essential part of a facultative wetland. The other advantage of papyrus is that it is a cash crop and the full-grown stalks could be harvested and sold, providing a small business for a local villager.

Additionally, as malaria is present everywhere in the area, The SAME team will also be introducing a plant-based remedy (Artemesia Annua) proven to work in other locations globally (**Anna Sofokleous**, AECOM, botanical lead) and Moringa Oleifera, whose seeds are a natural water-treatment coagulant and provide a valuable oil as a cash crop and whose leaves are a nutritional supplement for the local diet.

Samuel Ottensmann, SAE (University) Frankfurt will lead and direct the video team.

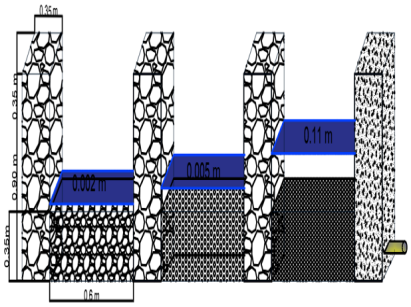
Prior trip summaries:

Trip one: Development of a slow sand filtration using local materials, basically a garbage can, piping and sifted sand. The initial filter was sized for a single family home. Prototype implemented and field-tested in one household.

Trip two: Implementation of a simplified salt chlorination system based on a car battery and solar recharge (see AECOM https://myecosystem.aecom.com/dept/csr/blueprint/SitePages/stories.aspx?storyid=1), simple enough for use by an uneducated populace, sustainable and inexpensive. Field-tested in four villages. Determined that 20 minutes reaction time was enough to generate a chlorine solution sufficient to disinfect the drinking water supply of a 100-person village. Team included volunteers from the SAME, Veolia Foundation, the Armed Forces Network, a Masters Student from the University of Trier, a future Masters student from the University of Grenoble, and a bachelor's student from SAE Frankfurt.

This was the first instance of utilizing the fieldwork as an opportunity for teaching university students. As a part of the fieldwork, a senior engineer would teach a student how to move beyond a traditional education into actual field conditions under the worst circumstances possible. This work included primarily adaptive engineering skills, creating something on the basis of what was available in the local area, rather than relying on what can be bought; understanding the culture and how it affects design, adapting to how water is used, rather than presenting a finished design and having the populace adapt; creating solutions when unanticipated circumstances arise. Additionally, the process allows for design independence, not only by the young engineers, but also in particular by our film student (SAE, Frankfurt) allowing him to develop his own documentary film. This is a wonderful opportunity to develop the next generation of engineers and filmmakers. Young people with the desire to serve, the will to see the work accomplished and now, the know-how and experience to spread the work to other places.

Trip three: On the basis of the limitations encountered in trip two and building on the lessons learned in trip one, developed a simplified rapid sand filter in a water tank. From the previous trip, field investigations determined that chlorine could be made more effective by reducing turbidity. After pilot testing in Germany, a rapid sand filter was built inside a black-walled PED water tank (the kind so common in Africa) at a local grade school. After successful completion and implementation, another opportunity presented itself where a similar-type filter could be built on a free-flowing spring serving five villages.



Funding: Traditionally private donations, (also one time grant from Veolia Foundation in 2016). Blueprint Travel Grant (AECOM) applied for in 2018 to assist funding. Other funding sources are being sought.

Organizations: UN, Ferrovial, WorldProject.ONG, Weebale Foundation, Veolia Foundation, AFN Kaiserslautern, USAFE, Mission Uganda

Schools: University of Trier (Hochschule Trier), Germany; Grenoble Institute of Engineering (Institut polytechnique de Grenoble), France; University of Granada (Universidad de Granada), Spain; SAE Institute Frankfurt (film documentary), Music University Freiburg, Germany (Musikhochschule Freiburg/Film music)

Publications: Three AFN reports (video), one AFN Radio report, two newspaper articles, articles in The Military Engineer, FamilyNEXT, a bachelor's thesis (University Trier), two Masters Theses (University Trier, University Grenoble) and one on-going Masters (University Grenada),

Videography: https://www.youtube.com/watch?v=e7bpBkONMXc
https://www.youtube.com/watch?v=lx9Rj3t-F3c
https://www.youtube.com/watch?v=-2VWFYjIHFo&t=13s
https://www.youtube.com/watch?v=9mxunJCmLTs
https://www.youtube.com/watch?v=GSXhrmmpBVA&t=68s
https://www.youtube.com/watch?v=Xs7lxVwuaz8&t=2s

Students 2018: Isabel Trinidad Mendez Mora, University Grenada, Masters Water Treatment; Samuel Ottensmann, SAE Film; Leon Roskoni, SAE Film; Kevin Martin, Ramstein Sr High School; Pascal Mompert, IGS Morbach (HS); Valentina Stoll (Laboratory studies, pathogens), Naturwissenschaftlich-Technische Akademie in Isny; Natalija Milanovic, University Darmstadt, (Bachelors, wastewater treatment)

MISSION UGANDA

Water for the Body
Education for the Mind
The Gospel for the Soul

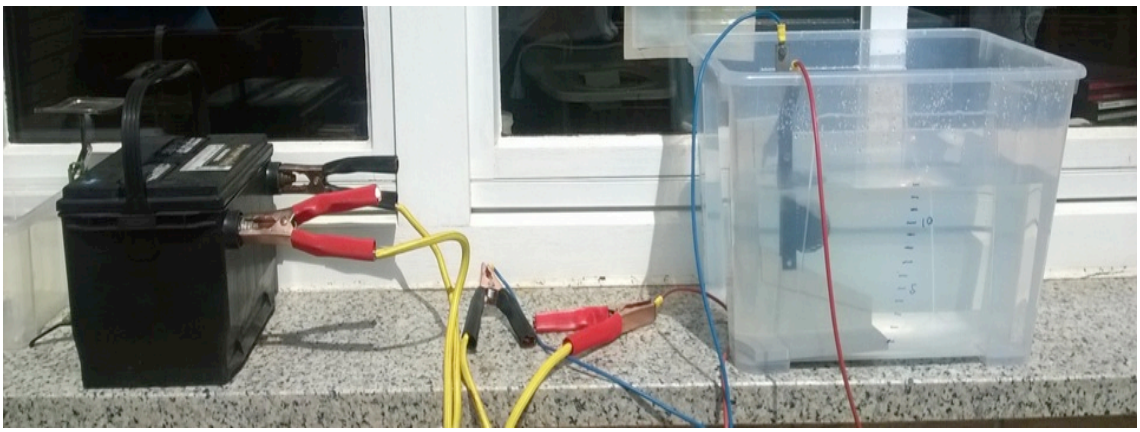
Mission: Amazonas 2019

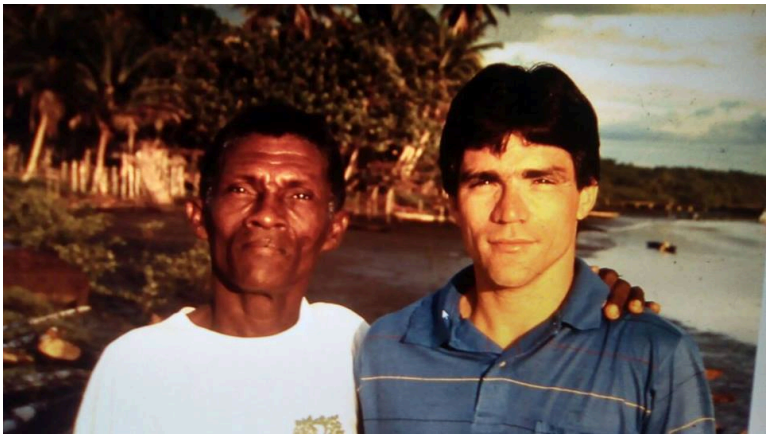
Preamble: Due to the success of the initiative in Uganda, I received a request from a group operating under similar conditions in the backwater communities of the Amazon River in Brazil (Oscar and Mariles de Oliviera, MEAP). Their work in Brazil is spiritual and they requested that I visit the villages for a week to determine the adaptability of the Uganda program to the villages on the Amazon.

Summary: Mission Uganda has created adaptive technologies to treat contaminated drinking water sources, using local materials and local labor. The concept has proven adaptive to other communities world-wide. The focus is primarily on small villages where no utilities are present, although the technology developed to date is adaptable to larger populations.

In February 2018, Michael Ottensmann was contacted by Oscar and Mariles de Oliviera of MEAP, who plant churches in small remote fishing villages along the Amazon. The social conditions – no utilities, minimal access to traditional markets for water treatment solutions – are similar to the situation in Uganda. Ironically, the distance to the equator is eerily close to that in Uganda, so the possibilities to implement solar solutions are also similar.

Because of the similarities in conditions, it is reasonable to assume that the solutions that worked in Uganda will, with adaptation to local culture, work in the Amazonas. On this basis, the request for an evaluation of local conditions is very reasonable. The requirements for a similar salt chlorination system are likely to be met. In the case of high turbidity, sand is prevalent along the Amazon, so it is expected that a sand filtration system similar to that used in Uganda will be easy to build and adapt to local conditions.



One goal of the trip, in addition to the recommendations report, is to find local sources for all required materials for the typical Ugandan systems – solar panels and regulators, water tanks, sand, etc. The solar panel will be sized to, at a minimum, meet the requirements of either the salt chlorination system or the power requirements for the incubator (bacteria test device), whichever is larger. In this way, proper bacteria testing is ensured. The intent would be to leave one complete salt chlorination set in an appropriate village.

Should the Lord bless this effort with funding, the trip would tentatively take place in February of next year.