

African Centres for Lightning and Electromagnetics Network (ACLENet)

Application to South America?

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Abstract—ACLENet, a nonprofit organization working in Africa to decrease deaths, injuries and property damage from lightning, was founded in 2013 in Kampala, Uganda. National Centres have developed or are developing in other countries. This paper outlines ACLENet activities and the challenges it has met and offers preliminary ideas on how these could be incorporated into lightning safety programs in South America.

Keywords—lightning, lightning safety, lightning injury, lightning death, ACLENet, lightning injury prevention

I. INTRODUCTION

ACLENet, the African Centres for Lightning and Electromagnetics Network, Inc., was formed in 2013 following a lightning protection meeting in Nepal where the founders met, discovered the huge death toll in Africa and decided that action was needed in Africa [1](Table I). ACLENet's mission is to decrease deaths, injuries and property damage from lightning across Africa by the formation of national centers and application of lessons learned with each project across many countries.

Over the five years since its founding, ACLENet has learned many lessons, some of which may help any similar organization in South America avoid the same pitfalls.

II. ACCOMPLISHMENTS AND LESSONS LEARNED

ACLENet has a broad range of goals [2](Table II).

A. National Centre Formation

Africa is not like the United States of America (USA) where customs, legal structure, and other factors make it relatively easy to translate an organization or business in one state to other states. There are 55 sovereign countries in Africa, each with its own laws, customs, government structure and stability and level of development. However, both the USA and

TABLE I. HISTORY OF ACLENET

Year	Event
2011	Kathmandu, Nepal, NAM S&T – Founders met Kathmandu Resolution to hold a similar meeting in Africa [3]
2013	Kampala, Uganda, NAM S&T meeting - Resolution to Establish African Center for Lightning Information and Research (ACLIR) [4] Makerere University Business School offers to host ACLIR headquarters (name later changed to African Centres for Lightning and Electromagnetics – ACLE).
2014	First Scientific Symposium, Entebbe, Uganda.
2015	First national centre, ACLE-Zambia, formed. ACLE changed to ACLENet as the international parent organization, reserving ACLE-country/region for national or regional organizations. Second ACLENet Scientific Symposium, Lusaka, Zambia
2015	Award of United Nations Global Resilience Partnership grant for \$1,000,000 in partnership with four other organizations to bring Severe Weather Early Warnings to those living around Lake Victoria.
2016	Incorporated in Uganda and in the United States with tax-exempt status granted.
2018	Awarded Ludwick Family Foundation Grant to fund public education and school protection

Modified from Cooper et al, 2018 [1]

TABLE II. ACLENET'S MULTI-FACETED GOALS

Areas	Programs
Education	<ol style="list-style-type: none"> 1. Conduct public education in lightning safety and injury prevention using such methods as: <ol style="list-style-type: none"> a. Newspaper inserts b. Television and radio specials and public service announcements c. Direct safety education at schools and other public venues 2. Work with teachers, government agencies, and others to promote lightning safety and improved building codes 3. Improve training and Continuous Professional Development (CPD) courses for engineers, architects and others involved with designing and installing Lightning Protection (LP) and encourage certification in these areas 4. Educate the public, governments and others to recognize and avoid faulty technology and fraudulent claims 5. Encourage and mentor both undergraduate and graduate training in electrical and lightning areas at universities across Africa
Lightning Protection	<ol style="list-style-type: none"> 1. Work with governments to adopt internationally recognized building and lightning protection (LP) codes and require their use for construction of public buildings and schools 2. Find funding for lightning protection of schools and other important public buildings 3. Work with LP experts to design low cost LP templates that can be applied to structures such as schools 4. Encourage construction supply companies to stock code compliant LP materials to avoid import fees
Research	<ol style="list-style-type: none"> 1. Collect data on lightning deaths, injuries and property damage for each country 2. Investigate effective measures that individuals can use to decrease their chances of lightning injury 3. Use data from lightning detection companies to determine lightning stroke density and risk maps for each country in Africa
Lightning Early Warning Systems	<ol style="list-style-type: none"> 1. Improve forecasting and availability of weather data to all citizens 2. Encourage the development of smart-phone apps for weather warnings 3. Develop and test systems for early warning of lightning danger
National Centres	<ol style="list-style-type: none"> 1. Foster national centre development recognizing that each country will have its own challenges and concerns, talents and individual strengths, but will work together 2. Organize regular symposia across Africa to bring together like-minded individuals and groups who are interested in public health and disaster management issues related specifically to lightning safety

Modified from M.A. Cooper and R. Tushemereirwe, 2019 [2]

African countries share many of the same frustrations with government bureaucracy.

Most of ACLENet's activities have been in Uganda to date, probably due to the strong leadership of its African founder, Ugandan Richard Tushemereirwe and regular meetings of a dedicated segment of the Executive Committee. ACLENet has been incorporated in both Uganda and the USA and awarded non-profit 501c3 tax status in the USA, a necessity for most grant applications. Subsequently, it has been registered as a community based organization in Uganda, required by many granting agencies. NGO (nongovernmental organization) status, often preferred by granting agencies, is particularly difficult to obtain in Uganda, partly because the national NGO review board only meets twice yearly and because of a complicated application process.

The first national centre was formed in Zambia in 2015. While both undergraduate and graduate programs in Electromagnetic Compatibility and high-voltage engineering have been approved by the University of Zambia's senate and administration, enrollment has lagged for lack of advertisement and funding. Other projects such as lightning protection of mines, utilities, and other industries, have

languished. Steps are being taken to re-energize the leadership and train them in essential leadership and grant-writing skills.

Several other countries have expressed interest in working with ACLENet and its leaders and in being included in ACLENet's activities, resulting in publications [5,6] and other output, but, to date, none have formed national centres due to many reasons including leadership, funding, experience, bureaucratic blockades and other factors, not to mention often the unreliable electricity supply and connectivity problems in many parts of Africa. It is anticipated that each national centre will have its own strengths, challenges, priorities and talents, all of which we hope to bring together to address lightning safety, injury prevention and property protection from a multidisciplinary and multitalented team.

B. Public Education

There have been several real successes in public education including newspaper inserts, lightning science and injury prevention seminars for parents, teachers, students, and local government officials at schools that have had lightning protection installed (see *D*), and with ACLENet's monthly newsletter [7].

TABLE III. LESSONS LEARNED FROM EDUCATIONAL SEMINARS

Forum	Lessons Learned
Zambia	<ol style="list-style-type: none"> 1. Advertise and send invitations earlier 2. Involve more schools 3. Do not overwhelm with too many detailed academic talks
Runyanya	<ol style="list-style-type: none"> 1. Test equipment and have power backups 2. Prepare handouts with key points for learners to share with their families and neighbors
Shone	<ol style="list-style-type: none"> 1. Pre-record talks on YouTube 2. Have expert for questions after presentation 3. Do not try to translate for all - Give separate talks for English speakers and non-primary English speakers

Educational newspaper inserts were chosen for Uganda because they have been instrumental in prevention of teenage pregnancy and HIV infection. Teachers often use the inserts as posters and lesson plans at their schools. The first ACLENet insert, distributed to 33,000 subscribers, was a joint effort with the Uganda National Commission on Science and Technology (UNCST) and garnered much interest and comment from not only the public but from those wanting to protect their homes, families, and schools for their children [8]. Interestingly, it also reached a missionary in the Democratic Republic of the Congo (DRC) who has become a citizen reporter of lightning injuries and deaths in the DRC where government instability prevents an organized press from reporting incidents.

The first educational seminar was held for teachers in Zambia the day following the 2015 Second Scientific Symposium with support of the United Nations Development Program.(Table III) The second was held at Runyanya School, the site of a lightning strike (not the first in this decade causing injuries) that killed 18 children and sent 38 more to the hospital [9]. A third was held at Shone School near Hoima, Uganda, for parents, teachers, students and local government officials.

C. Data Gathering

To influence change-makers such as governments, funding agencies, and donors to do something about lightning deaths, injuries and property damage requires that they must first be aware of the problem - and that takes data. Since there are no African countries that require reporting of deaths and injuries by lightning, we are dependent on the internet.

In developing countries, news reports may be written days after an incident, often by journalists who have no first-hand knowledge of the incidents. Reports involving multiple casualty incidents, children or curiosities like animal deaths are more likely to be reported than a single death or injury. Despite these problems, internet news reports of lightning injury remain one of the best sources of data for developing countries, certainly across Africa where ACLENet works. These reports can be useful in raising awareness with governments, granting agencies, donors and in newsletters [10].

Daily internet searches can be set up to collect news reports although they must be screened because 95% of the citations are about sports teams, commercial products, and other non-casualty uses of the word ‘lightning’ [11].

Because of the many languages spoken in post-colonial Africa, ACLENet has recruited volunteers to screen internet searches in Portuguese, French, and Spanish and would like to recruit volunteers for other languages used in African newspapers. ACLENet’s website, <https://ACLENet.org>, is already translatable into over 100 languages thanks to Google Translate technology. Additionally, others have volunteered to report incidents in countries where an organized press is unavailable to report incidents.

D. Lightning Protection (LP)

The majority of sub-Saharan dwellings are not lightning safe, leaving families at risk 24/7 whether they are at home, working, walking to market or studying in school. (Fig. 1)

In an early survey of newspaper reports of lightning deaths and injuries, ACLENet found that more people are killed in schools than any other situation. Classes tend to be 50 children per teacher in unprotected, usually concrete buildings. Schools

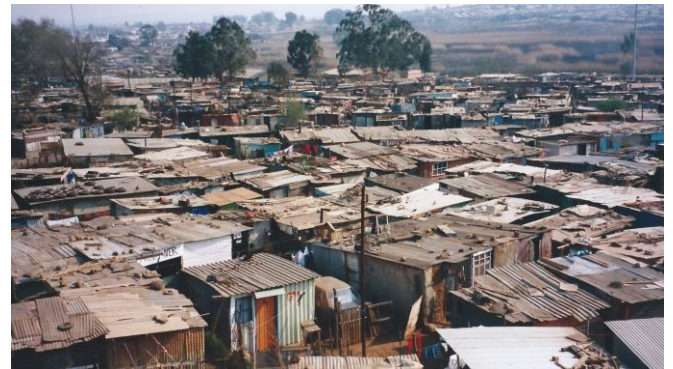
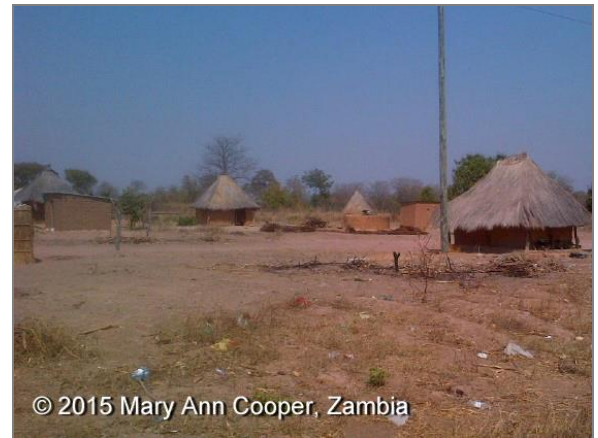


Fig. 1. Typical African dwellings and work areas, particularly in rural areas. Fig. 1a. Mudbrick with generations-old thatch roofs or sheet metal held down by rocks. In some areas, chicken wire may be cast over the thatch to prevent monkeys and baboons from disrupting the roof. In others, car tires may be placed on the roof because it is thought that their ‘rubber’ will protect the building from lightning. Fig. 1b. Soweto shantytown. Soweto is a million-plus populated South West Township near Johannesburg and the birthplace of Nelson Mandela. (courtesy Derek Elsom)

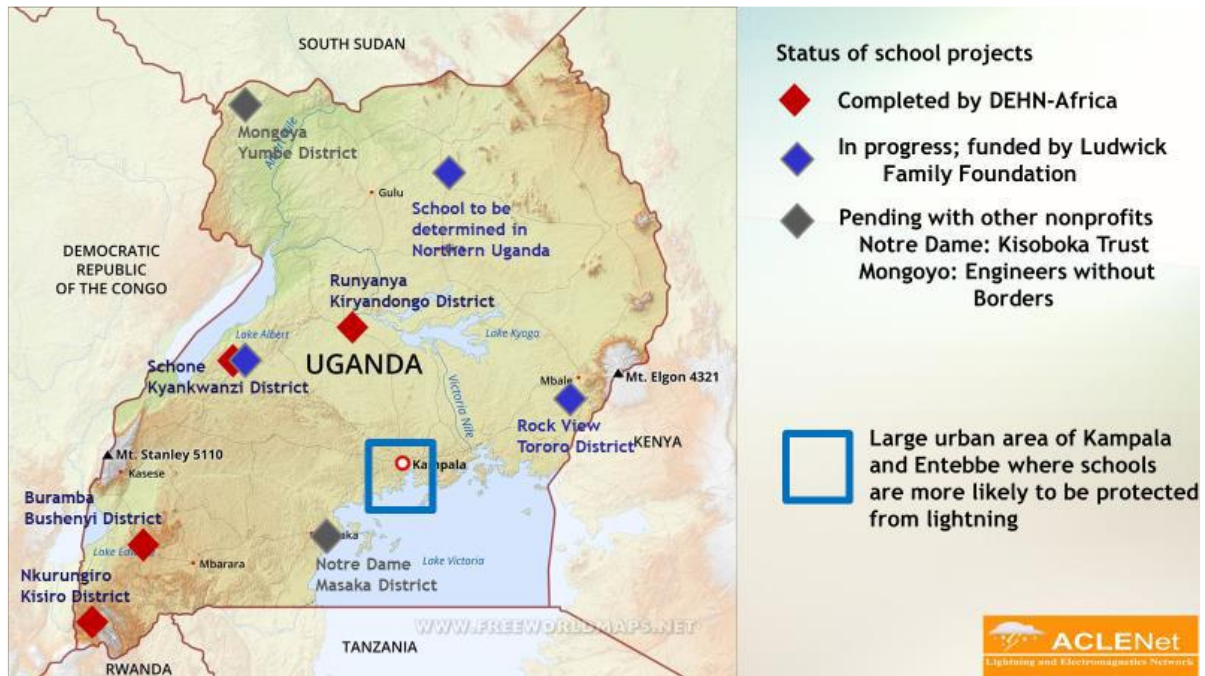


Fig. 2. Schools with lightning protection provided by donations and grants

tend to be the most substantial buildings in most non-urban communities and are a natural meeting place to hold public educational lightning safety programs. For both reasons, in 2014 ACLENet challenged lightning protection specialists and researchers attending the International Conference on Lightning Protection meeting in Shanghai to protect schools in Africa. DEHN was the first to volunteer and supplied materials for several schools. (Fig. 2)

A grant from the Ludwick Family Foundation has allowed ACLENet to expand its activities in many areas including the protection of three more schools. Dedicated LP experts, all volunteers from the Lightning Protection Institute in the USA and Lightning Protection Concepts in South Africa have formed ACLENet's Lightning Protection Working Group (LPWG) to design IEC 62305 compliant lightning protection systems for these schools.

Schools in Africa often have 3 to over 20 small classroom, dormitory and other buildings, sometimes making LP more expensive than protecting one large building as schools tend to be in developed countries. When LP materials must be imported, shipping and customs fees, and often airport storage fees, add to LP cost. To decrease this, ACLENet and the LPWG are committed to adapting the designs they make as templates that can be used by other schools across Africa which will decrease design costs. Additionally, we plan to work with LPWG to potentially source materials locally as well as encourage building supply companies to stock code compliant LP materials.

There is a large amount of misinformation and misrepresentation in the African public concerning LP. Even more worrisome is the lack of appreciation of standards in LP.

This is mainly due to economic ecosystems built in Africa over a period of many decades.

Manufacturers and vendors of Early Streamer Emission products have built strong networks and an ecosystem that discourages any discussion of standards to surface in the media. This has encouraged proliferation of substandard LP even where funding is not a problem like in the World Bank funded classroom construction project in Uganda.

Part of improving LP is working with governments to adopt accepted international LP codes such as IEC 52305 in their building codes and require their use for public buildings and especially schools.

E. Work with governments

ACLENet has formed a close bond with UNCST and is working with the Uganda Ministries of Education and Sports (MoES) and Disaster Planning (MDP) to save lives. ACLE-Zambia has recruited over twenty stakeholders including utilities, mines, government, aviation and others to support their efforts.

In most African governments, bureaucratic grid-lock is disabling and can easily wear out initial morale for a young organization. For an organization which is international, operating across many cultural boundaries and political boundaries, a unique approach is required to address the bureaucratic barriers. For ACLENet, it was resolved early, during formation stages that national champions for lightning safety and injury prevention should be citizens of the country involved. This helps in forging organic growth.

F. Customs and Cultural Beliefs (Table IV)

These run deep across all of Africa: customs and beliefs are taught from generation to generation by word of mouth and are strong in Africa partly due to low levels of literacy, especially functional literacy.

Even after Europe colonization, which drew national boundaries across tribal lines, tribal identity continues to form much of the culture of Africa. Every tribe in Africa has a unique storyline on the origins and nature of lightning that forms the common understanding and creates the illusion that scientific attempts at addressing the lightning hazard are futile.

Only by gaining the respect and trust of individuals, particularly the elders, within the tribe can these beliefs be addressed and countered.

G. Funding

Another cultural practice that is well known in Africa is 'NGO disease'. Africans have become used to well-intentioned organizations coming into their communities for two or three years with money to do projects - which may or may not be considered beneficial by the community. NGO's are well known to have money that villagers are more than happy to accept for work or other activity. Villagers know that when the NGO leaves, whatever project the NGO was involved with will more than likely die.

Sustainability is a huge issue for any nonprofit / NGO in Africa. Grants may be difficult to come by and require dedicated focused effort. Proper financial management and practices, required by many foundations and grants, can be difficult to ensure in a largely cash economy like Africa. Volunteers are wonderful and often essential, but there are still the operating costs for communications, connectivity, fuel, bank charges, rent, and many other expenses and grants will often not cover administrative costs.

It is a very practical matter that most people in Africa must work every day to feed their families. Offering educational seminars to farmers and fisherfolk that takes them away from the work that will feed their family that day means that most attendees will expect to be paid for their transportation expenses and lost wages as well as to be fed while they are attending. This is a very foreign concept to most who live in developed countries so that grant programs often do not

TABLE IV LIGHTNING BELIEFS COMMON ACROSS AFRICA

Wearing red attracts lightning
Mirrors can attract lightning or reflect it to kill you
Using muthi (traditional medicines and charms) can prevent lightning injury
Those who are struck by lightning are evil people who deserved it
Individuals can call down lightning to injure people they have conflict with
Witches (usually widowed older women with no one to defend them) may be stoned for calling down lightning to hurt someone

understand this. Government officials who attend may expect an extra premium payment for their attendance and transportation, regardless of whether their attendance could be judged to be part of their salaried work. Budgets must accommodate these expectations.

III. SUMMARY

We have attempted to relate the accomplishments and many of the lessons we have learned over the last five years since ACLENet was founded. If lightning safety leaders in South America choose to follow our lead, we hope that they can learn from these stories and plan for or avoid many of the challenges we have faced. Regardless of all the planning they do, there will be surprises, setbacks and many rewards in working to save lives and prevent deaths, injuries and property damage from lightning. ACLENet stands ready to assist as needed.

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