RURAL COMMUNICATION NETWORK TRIAL PROJECT
Mumbwa District, Central Zambia

Project Report and Recommendations
June 2009

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Executive Summary

Connect Africa is a rural service network that has developed a "best for purpose" information and communication technology (ICT) and logistics infrastructure to facilitate the delivery of multiple services to rural communities in Africa.

Using a unique combination of social enterprise and entrepreneurship, Connect Africa provides a gateway for public and private sector organisations to deliver their respective services directly to the rural people of Africa.

With the support of several stakeholders from both the public and private sectors, Connect Africa deployed a three-month rural communication service trial in central Zambia's Mumbwa district. The trial took place April to June 2009.

The objective of the project was to test the technology, management and logistics of Connect Africa's rural network model and to determine user demand and commercial viability.

Six deep rural communication points were selected, and each provided with a satellite community phone. Five phones were provided by Fort Telecom using the Thuraya satellite network and one phone was provided by GlobalCom using the Iridium satellite network.

A range of deep rural locations were selected and included a school, clinic, Zambian Wildlife Authority (ZAWA) office, two roadside kiosks and a beer hall.

Local operators were selected and trained by the regional coordinator in close cooperation with the traditional leaders of the area.

These service points were monitored and managed over a period of three months and the results of the project are detailed in this report.

Ultimately the project was a resounding success with demand for communication services firmly established. The technology worked well despite airtime issues and the lack of call data reports needed to manage the network efficiently.

It was clearly established that it is the rural people and communities themselves who should determine what service levels are needed. Connect Africa will then use the most appropriate technology to facilitate this demand-led service requirement.

Flexibility in the use of appropriate or "best for purpose" technology will ensure optimal service levels delivered at optimal cost.

This means a flexible combination of satellite, cellular, landline, local loop, WiFi and WiMax technologies can be used in any rollout.

The key to operational success lies in logistics. The routine maintenance, cash management, training and ensuring optimal service levels all contribute to the efficiency of the service that will in turn determine its long-term sustainability.

Power supply requirements will similarly require flexible solutions with hybrid combinations of different technologies being used. The trial successfully utilised a hybrid solution of a small 12V motorcycle battery connected to a zinc air fuel cell provided by the Alternative Energy Development Corporation.

It was clear from the project that the sustainability of any rural service network will depend upon sustained revenues being generated, and these revenues will have to come from facilitating the delivery of value added services on behalf of multiple public and private sector service providers.

The revenue generated purely from voice calls? will not be enough to build and maintain a sustainable rural service network.

The recommendation in this report proposes that a service network of at least 20 (preferably 40) service centres be rolled out across at least one district. One module (20 service centres) will offer a comprehensive service infrastructure to rural users and service providers.

This district rollout should be maintained and enhanced over a period of twelve months to establish an optimal service level. The network will have to service a critical mass of rural communities in order to attract the participation of the public and private sector service providers needed to make the network sustainable.

The recommendations also propose that Connect Africa approach the Communications Authority of Zambia to secure funding from the Universal Access Fund to finance the establishment and deployment of the initial district network.

Connect Africa's Mission

Connect Africa's vision is to improve the social and economic wellbeing of rural communities across Africa.

By means of a unique combination of social enterprise and entrepreneurship, Connect Africa has developed a "best for purpose" ICT and logistics infrastructure to facilitate the delivery of multiple public and private sector services directly to the rural people of Africa.

This ICT-driven rural infrastructure will serve as a gateway for service delivery across Zambia and form the basis of a model for the rest of Africa – and beyond.

1. Project Background

a. ICT environment in the Zambian trial region

Zambia's ICT landscape is driven by the government's ICT policy and the Communication Authority's regulatory practices. The Ministry of Communication and Transport is responsible for the formulation and implementation of ICT policy and launched the ICT Policy in 2007. The government is now in the process of implementing its plan.

Like many other African countries, Zambia still faces infrastructure challenges, particularly in rural areas where existing ICT infrastructure is often negligible. The problem is further exacerbated by the lack of adequate energy infrastructure required to improve ICT penetration. The hydro-electric grid was developed primarily to power the copper mines in the Copperbelt region. Though power lines serve all major towns, vast areas of the country are not serviced by the national grid. This lack of power has resulted in inhibiting private sector investments to most rural parts of the country. A reliable and affordable alternative to national power will enable the use of ICTs in rural schools and remote villages and towns. Renewable energy sources, such as solar power units, could be viable alternatives sources with low power consumption.

The Mumbwa District is situated 150km west of the capital Lusaka in the Central Province of Zambia. It is accessed by the main tarred Lusaka-Mongu road that stretches from Lusaka west to Mongu, the capital of Western Province. The district shares borders with Kaoma in the west, Itezhi-tezhi and Namwala in the south, and Chibombo, Luanshya and Kasempa to the north. The Mumbwa district constitutes 25 percent of the central province, covering a total land expanse of 23,800 square

kilometres, of which 12,600 square kilometres are arable land and 11,200 square kilometres are national parks, game management areas (GMAs) and forest.

The total population of the district is approximately 158,861, out of which 49.77% are women. (*2000 CSO*) The population relies on subsistence agriculture, predominantly maize and cotton, as well as the one cotton ginnery, which employs a significant number of seasonal workers. The district is rich in mineral deposits such as copper, gold, amethyst, magnetite and quartz. The district also attracts wildlife tourism to the Kafue National Park on its western border.

The Kaoma district is located approximately 400km west of the capital Lusaka and is accessed by the same road passing through Mumbwa. The district has an area of 23,315 square kilometres and has a population of well over 113,000 people. Eight-five percent of the population are supported mainly by traditional and small-scale agriculture.

The road and rail belts cover the more productive regions of Zambia (*Livingstone to the Copperbelt*), but rural areas further from the road and rail have limited access to ground telephony, mobile and internet services. Moreover, access to internet communications is further constrained by the high cost of services.

Zamtel, the government-backed parastatal communications company, has limited capacity to provide land-line and other forms of communications to the rest of the country, and this is particularly noticeable in the rural areas. The cellular networks have in turn made some inroad into rural coverage but this remains limited to trunk routes and major towns.

The district of Mumbwa was chosen for this trial because of its remote location and lack of service infrastructure. Connect Africa liaised closely with the Zambia Wildlife Authority (ZAWA), who are responsible for the vast GMAs surrounding the Kafue National Park, in which several of our service centres were installed. Another service centre was installed on the western boundary of the park in the Kaoma district.

b. Project Rationale

Many projects have attempted and failed to address the challenge of rural service delivery in Africa. Innovative ideas, often using ICT, have been attempted across the continent, but many have proved unsustainable.

Connect Africa has developed a model that combines the critical elements required for a sustainable rural service delivery network:

i. Best for purpose ICT
ii. Government engagement, participation and support
iii. Business engagement, participation and support
iv. Community engagement, support and training
v. Logistical and maintenance infrastructure
vi. Social enterprise and entrepreneurship
vii. Sustainable business model

These elements combine to provide a rural service model suitable for use by all rural communities, with sufficient flexibility for adaptation to specific local circumstances.

Connect Africa developed the model and initiated the project in rural Zambia to test and further develop the rural service network concept. The results of the trial are presented in this report.

Key partners were approached to assist with the project:
The Southern Africa Trust for funding, Iridium for satellite technology services, Fort Telecom for satellite technology and network services (Thuraya), Zambian Association for the Advancement of ICT (ZAA ICT) for local logistics and management support and the Communications Authority of Zambia for the necessary authorizations and government support.

c. Stakeholders

i. **Southern Africa Trust** – www.southernafricatrust.org
The Southern Africa Trust's objective is to improve the capacity of civil society to engage in and influence public policies to overcome poverty and inequality. Connect Africa's project addresses these issues directly and, based on previously successful engagements with the Southern Africa Trust, Connect Africa was able to secure $50,000 in project operation funding from the trust.

ii. **Iridium** – www.iridium.com
Iridium is the only truly global mobile satellite communications company. Connect Africa has a long relationship with Iridium and four Iridium demo SIM cards were provided for this project, Three BravoTel phone units were provided by Iridium's agent in South Africa, GlobalCom.

iii. **Fort Telecom / Thuraya** – www.forttel.com / www.thuraya.com

With offices in the Middle East, Africa and North America, Fort Telecom provides wireless solutions to enterprise and government. Fort provided Connect Africa with 5 Public Calling Offices (PCOs), the Thuraya satellite networks' public phone product on their competitive ECO SIM rate of 40c (US) per minute.

iv. **Alternative Energy Development Corporation (AEDC)** – www.aedc.co.za :

AEDC has introduced the world's first commercialized zinc-air fuel cell energy solution. These fuel cells have a zero carbon footprint and have been used to provide power to several of the Thuraya PCO's in the field.

v. **Communications Authority of Zambia (CAZ)** – www.caz.zm

CAZ's vision is to create an efficient and competitive ICT sector that provides reliable and affordable goods and services of quality that are accessible to and meet the needs of the Zambian community.

CAZ provided the required authorization for the project.

vi. **Zambian Wildlife Authority (ZAWA)** – www.zawa.org.zm

Zawa's mission is to contribute to the preservation of Zambia's natural heritage and biological diversity for present and future generations through the careful conservation of Zambia's wildlife.

Connect Africa secured permission to operate in ZAWA's GMA surrounding the Kafue National Park in Central Zambia. The GMAs are home to many deep rural communities who have not benefitted from the technology revolution and Connect Africa is working with ZAWA to remedy this.

vii. Traditional Leaders in Central and Western Zambia

The local traditional Chiefs in the Mumbwa region were integral in deciding which villages or communities were to be serviced and who should be appointed and trained as the local operator. The support of the traditional leadership in rural areas is essential to ensure the success of any rural venture.

2. Project Scope

To deploy, manage and monitor six community phones connecting six deep rural communities in Central Zambia to the broader community.

The Mumbwa District in Central Zambia was selected on the basis that ZAWA's Kafue National Park, with its extensive and remote GMAs, would provide significant numbers of deep rural communities without access to any cellular or internet-based technology.

Connect Africa consulted with the region's traditional chiefs to select the trial villages or communities and to advise on the selection of local operators. ZAWA's senior ranger, Lackson N'Gandu, and Connect Africa's regional coordinator, Prince Lloyd Kabulwebulwe, facilitated discussions with Chieftainess Kabulwebulwe, Chief Chibuluma, Chief Mulendawa, Chief Muwezwa and Chief Kahale.

Fort Telecom had provided five Thuraya PCOs and Globalcom provided one handset, so Connect Africa and the regional chiefs selected six rural communities for the trial.The locations were determined based on the infrastructure available in the community to ensure the equipment could be kept clean, secure and dry. The selected communities each had a population of at least 3000 to ensure sufficient demand for a commercially based community phone service.

The following locations were used for the project:

Name	GPS Coordinates	Location	Type	Operator
Mukokmena Village	S 15.01.331 E 26.52.190	Purpose built traditional hut	BravoTel/Iridium	T Belengu & Maureen
Nakanjori Village	S 15.09.291 E 26.45.207	School	Thuraya PCO	N Evans
Makunku Village	S 15.23.718 E 26.47.368	Clinic	Thuraya PCO	C Mumba
Nalusanga Gate	S 14.58.237 E 26.42.661	Kiosk/shop	Thuraya PCO	Doreen K
Chunga Camp	S 15.02.563 E 26.00.003	ZAWA Office	Thuraya PCO	Beatrice Njungu & Hilda
Tobacco Board of Zambia (TBZ)	S 14.53.109 E 25.23.055	Beer hall	Thuraya PCO	S Situmbeko

4. Project Objectives

a. Overall objective

To determine the demand for and sustainability of a pay-phone communication network with related services in the rural areas of Zambia. The Zambian network will then provide a model for rural communication across the rest of Africa and beyond.

b. Testing the technology

To test the technology for purpose, effect, efficiency, robustness, usability and cost/benefit.

c. Determining commercial viability

To determine the viability of a commercially based community phone network based on the user demand and activity analysis.

d. Test management & logistics

To determine the field management and logistical requirements to be provided by a rural service network operator.

5. Technology

The technologies utilised in this project were voice based satellite services, provided by Fort IT, the Africa distributor for the Thuraya satellite network, and by the Iridium satellite network. Power for the phone units was provided primarily by Zinc Air Fuel Cells, an alternative energy solution from the Alternative Energy Development Corporation (AEDC).

a. The Thuraya Public Call Office (PCO)

The Thuraya PCO was selected on the basis that a competitive call rate of US39c per minute was charged on their ECO SIM rate for developing countries. This enabled Connect Africa to charge the end user the equivalent of US40c per minute, which is in line with standard pre-paid and community phone rates on cellular networks across Zambia.

Thuraya's network coverage extends to the Southern border of Zambia and call quality tests prior

to the deployment of the project network showed good results, even at the southernmost PCO location.

Installation and operation of the unit was simple, allowing for operators to be trained in 30 minutes. Full installation could be completed within two hours.

Limitations

Thuraya did not provide any technical assistance so the PCOs were not used to their full extent, i.e. SMS text messaging activation, unit report and billing activation and complex charging structure implementation. Although not critical to the project objectives, this would afford significant flexibility and flexible charging structures for future operators.

A more significant negative effect to the project objectives was Thuraya's inability to provide the comprehensive call data reports essential to the PCO network management and call charge reconciliations. As a result, daily usage could not be remotely managed and significant periods of "down time" were suffered while additional airtime was purchased through a laborious and time consuming funds transfer process. These delays were further exacerbated by the unexpected high demand experienced in some of the locations.

The project budget limited the amount of airtime that could be purchased, which clearly was not sufficient to maximise the service. Despite repeated requests, Thuraya refused to "open" the SIM cards to enable the maximum call volume in any month to be determined. For this reason, the project outcomes do not show the optimum results that could have been achieved.

In addition to its poor call data reporting and limited coverage below 11 degrees latitude, the Thuraya PCO cannot accommodate internet and data services and Thuraya intimated a future increase in call charges. For these reasons, the Thuraya PCO is the minimum entry-level communication product for a rural network.

b. The Iridium Pay Phone

A strong partnership with Iridium enabled Connect Africa to secure up to four demo-SIM cards (free of charge) to be installed in two types of community phone handsets. The first was a public calling unit built by Visiontek in India and the others were custom-built portable and solar powered units provided by GlobalCom in South Africa.

Call data reports were routinely provided and the Iridium network coverage was not limited in any way. Iridium's technical, service, and call data backup are also excellent. Combined with unlimited global coverage, these elements make a case for Iridium to be a primary voice network service provider for the Connect Africa rural service network.

Iridium has recently launched a marine voice and data product (OpenPort) that could offer increased service levels in a robust casing, ideal for rural communication. Competitive data and call charges will need to be negotiated.

Limitations

All handsets were second/third hand and ultimately only one of the BravoTel units was able to be used for the full duration of the project.

The antenna for the BravoTel unit was not ideal and significantly better performance could have been obtained with a bigger antenna.

c. Alternative Energy Development Corporation (AEDC)

Multiple 12V Zinc Air Fuel Cells were provided by AEDC to power the Thuraya PCOs. It was estimated that each fuel cell, which works on the basis of electrolysis between a metal cathode and a replaceable zinc anode, would provide power for the PCO for up to four weeks.

Recharging was simply a matter of replacing the zinc anode and refilling the cells with purified water and KOH electrolyte. The used zinc anodes could be either recycled into new anodes or dried and used as crop fertilizer.

Recent developments in fuel cell technology have produced stronger, longer lasting and rechargeable cells (without having to replace anodes). These developments have resulted in better performance and operational cost savings.

Limitations

The trial project revealed that the basic 12V fuel cell was unable to supply the initial power spike required to connect a call and a small 12V motorcycle battery was introduced to the power supply system. The fuel cell then provided a trickle charge for the battery – an efficient and reliable solution.

It is proposed that this new generation of fuel cell technology be utilised in the district rollout, along with other alternative energy solutions such as solar and wind power.

6. User Response including Call Data Analysis

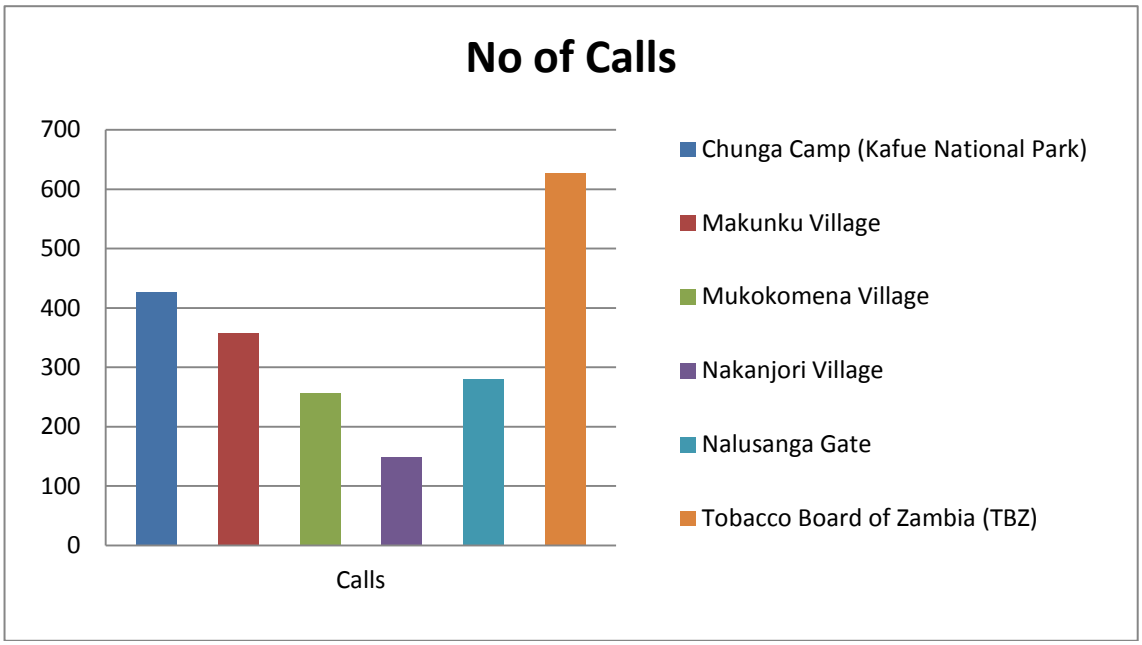
- Total number of calls for the period is 2098.
- The average duration of a call is 54 seconds.
- No calls were made before 04:00 or after 21:00. The busiest times are between 07:00 and 14:00.
- 96% (2018) of all calls were made to telephones in Zambia. The breakdown of these are as follows:

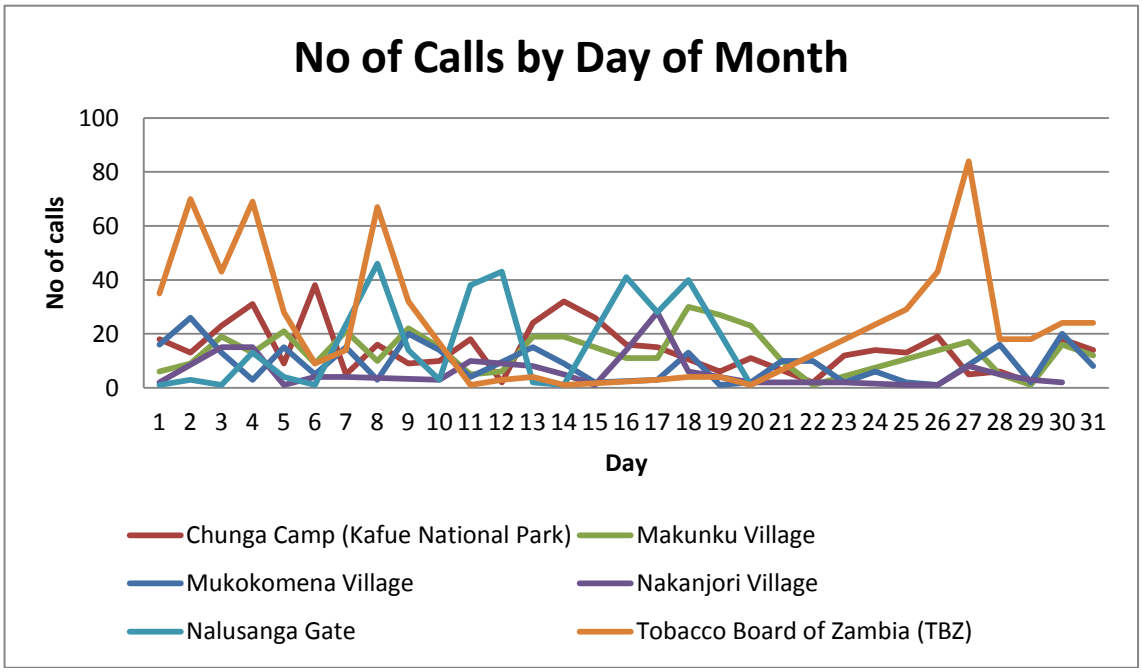
Destination	No of calls	Percentage
PCO-PCO	23	1%
Cell Z / Zamtel	73	4%
Celtel / Zain	1811	90%
MTNZ	83	4%
Zambia misdial	19	1%
Zambia National	9	0%
Total	**2018**	**100%**

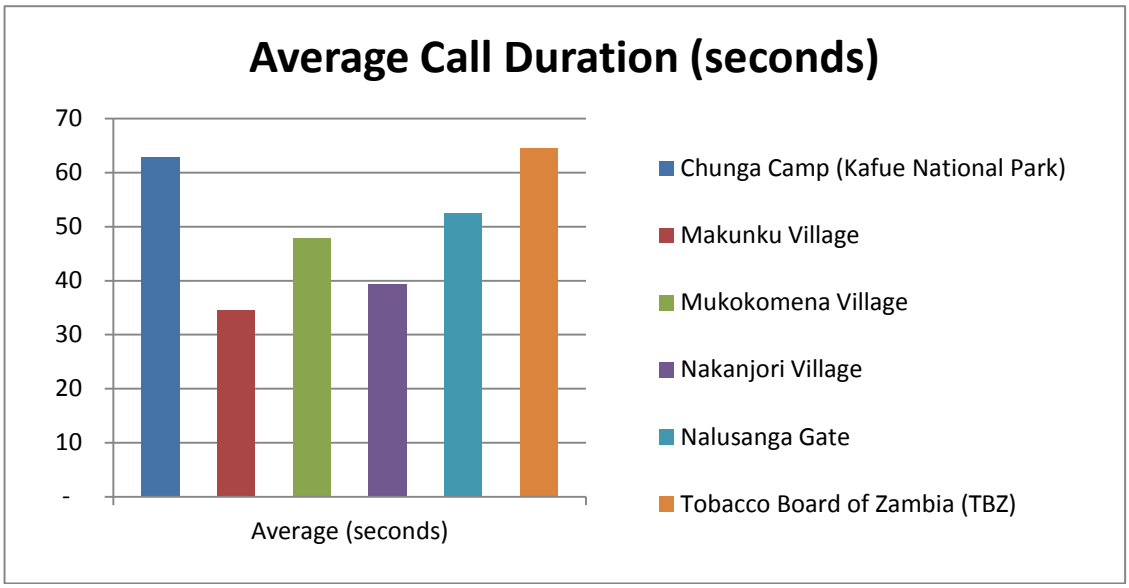
- Nalusanga Gate only used the phone for the first 20 days and then only once again on 8 April 2009.
- 50% of all Iridium calls were made within 156 days (83%) of the data period (189 days). The remaining 50% of calls were made in the last 32 days (17%).
- 50% of all PCO calls were made within 25 days (24%) of the data period (106 days). The remaining 50% of calls were made in the last 81 days (76%).
- 34% of all Iridium calls were made in the last 10 days of the data.

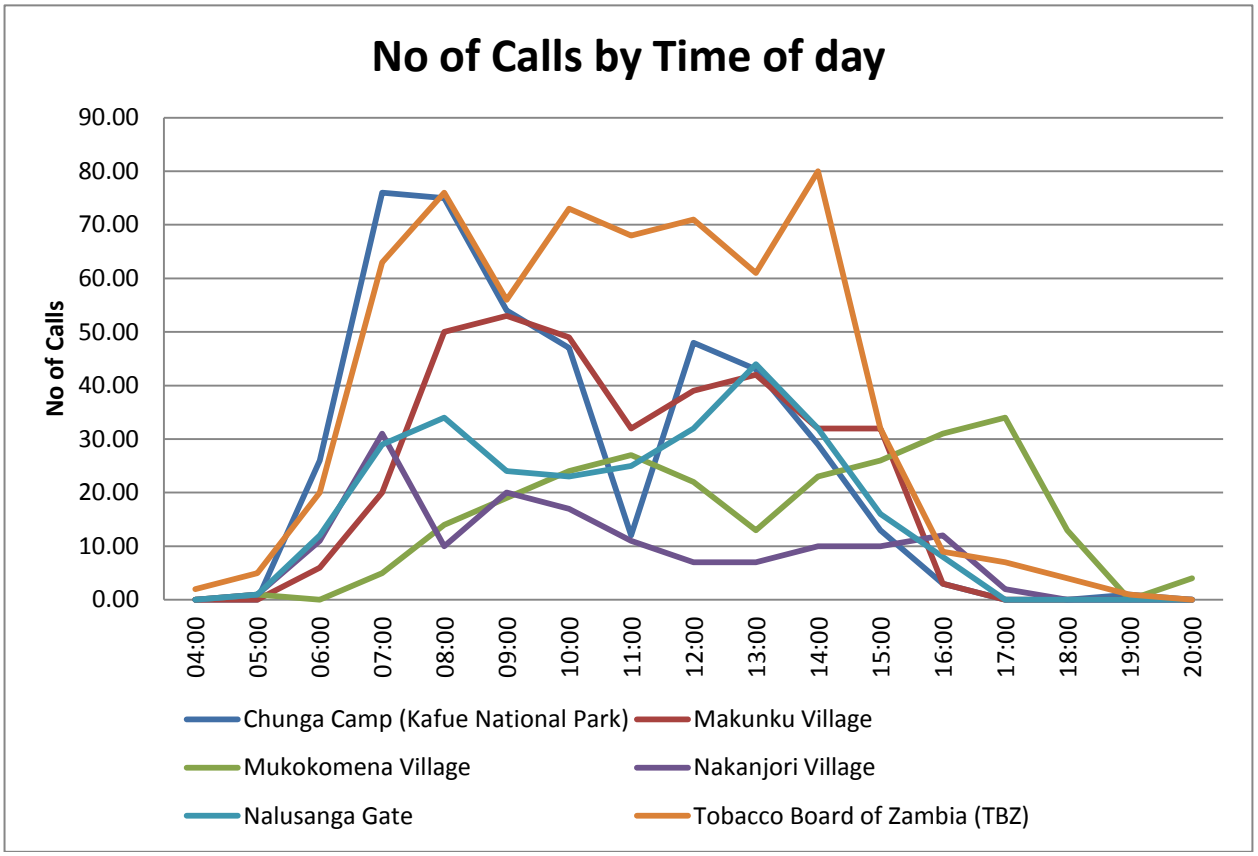
- 5% of all PCO calls were made in the last month.
- Call volumes peaked on 4 dates, 02 March 2009 (58 calls), 17 March 2009 (84 calls), 04 April 2009 (69 calls), 10 April (15 calls) and 08 April 2009 (66 calls). All these calls were made from Tobacco Board of Zambia (TBZ).
- Week 1 of each month seems to have the highest call volumes, 31%, of all calls.
- 2nd, 3rd, 4th, 8th and 27th of each month had the most number of calls.
- Average call duration of Mukokomena Village (Iridium calls) seem to be constant with a downward trend towards the end. 4 Hikes on 1st, 8th, 15th and 19th of a month.
- Average call duration of PCO calls varies a lot with a upward trend towards the end. Some spikes in Nakanjori Village and Chunga Camp (Kafue National Park).
- Tobacco Board of Zambia (TBZ) had the most number of calls with the longest call averages for this period.
- Celtel / Zain remain the operator with the most called numbers. 90% of all domestic calls made to Celtel/Zain.
- Overall decrase in the usage of the phones.
- Top 5 called numbers = 8.29% (174 calls) of calls, although 35% (61 calls) of these calls seem to be misdialled.
- Top 10 called numbers = 11.39% (239 calls) of calls, although 31% (73 calls) of these seem to be misdialed.
- All calls were made to 1008 distinctive telephone numbers. 58% (587 numbers) of these numbers received only 1 call.
- All calls were made to 1008 distinctive telephone numbers. 58% (587 numbers) of these numbers received only 1 call.
- 80 Calls were made overseas. The table below is broken down per country called:

Calledlocation	Chunga Camp (Kafue National Park)	Makunku Village	Mukokomena Village	Nakanjori Village	Nalusanga Gate	Tobacco Board of Zambia (TBZ)
Comoros/Mayotte Island						1
Czech Republic	4					
Malaysia			1			
Satellite misdial	1	2		32	8	18
South Africa			3		1	1
United Arab Emirates	3					
United States			5			
Total	**8**	**2**	**9**	**32**	**9**	**20**


No of Calls
700
600
500
400
300
200
100
0
Calls
Chunga Camp (Kafue National Park)
Makunku Village
Mukokomena Village
Nakanjori Village
Nalusanga Gate
Tobacco Board of Zambia (TBZ)


No of Calls by Day of Month
No of calls
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day
Chunga Camp (Kafue National Park)
Makunku Village
Mukokomena Village
Nakanjori Village
Nalusanga Gate
Tobacco Board of Zambia (TBZ)


Average Call Duration (seconds)
70
60
50
40
30
20
10
-
Average (seconds)
Chunga Camp (Kafue National Park)
Makunku Village
Mukokomena Village
Nakanjori Village
Nalusanga Gate
Tobacco Board of Zambia (TBZ)


No of Calls by Time of day
No of Calls
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
04:00
05:00
06:00
07:00
08:00
09:00
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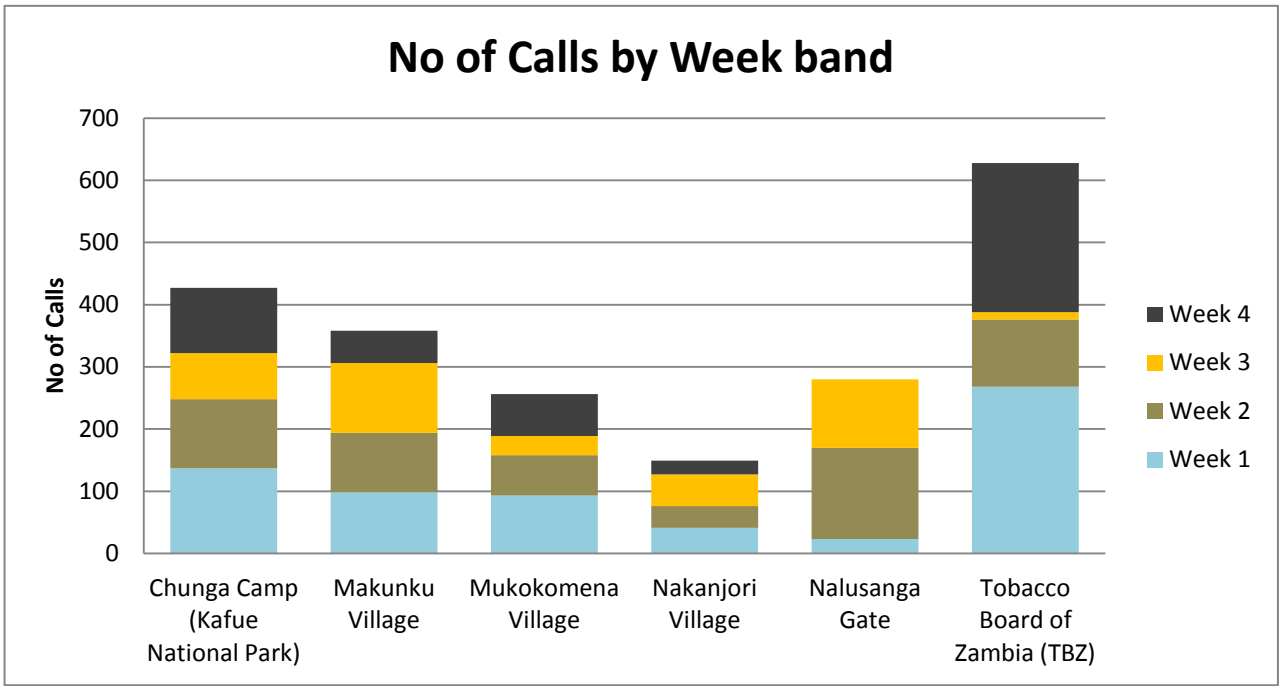
Chunga Camp (Kafue National Park)
Makunku Village
Mukokomena Village
Nakanjori Village
Nalusanga Gate
Tobacco Board of Zambia (TBZ)



7. Commercial viability

The trial proved that communication revenue alone will not be sufficient to sustain a satellite linked rural communication and service network. Furthermore, without government support in the form of network charge waivers there is not sufficient margin in a voice based rural service to sustain such a network.

Thuraya's 39c (US) per minute ECO SIM rate is the most competitive satellite call rate available in the World today (although these charges may increase in the near future). Matching Zambia's cellular call charges of around 40c (US) per minute afforded Connect Africa a 1c margin (exchange rates permitting) which is not sufficient to cover the operational expense of managing a rural network.

This problem will be exacerbated in countries offering more competitive cellular call charges.

Commercial viability lies in multiple service delivery generating multiple revenue streams for the network from a combination of government and private sector partnerships.

a. Information and Communication Revenue

i. Commercial network service providers

The lowest possible commercial call charge rate must be negotiated with network service providers on the basis that the service provider will be assisting in the development of underserviced rural areas around the world. A geographically fixed and measurable communication network can be easily monitored, managed and controlled. Maximum bandwidth demand can be accurately calculated and network charge discounts can be negotiated without undermining commercial rates. The rural network registered as a legitimate social enterprise will be able to mitigate discounted network charges by offering tax and social responsibility benefits to the providers. In order to capitalize on new emerging markets the network service providers will need to adopt a low margin/high volume business approach – not dissimilar to the Grameen approach in India.

ii. Government communication authorities

Authorities must recognize that the high cost/low return nature of rural service delivery will require a progressive and relaxed regulatory approach to enable service providers to provide a profitable and sustainable service to rural communities. A reduction or waiver of government charges for a rural network will enable the rural service provider to earn a margin on call and data charges which will ensure the sustainability of the service.

The fixed nature of the network and the easily measurable network usage at each installation will ensure that any waiver or fee reduction can be accurately controlled and monitored without compromising the government's regulatory environment.

iii. Other Government Department Service Delivery

Service delivery agreements paid through effectively managed monthly retainers should be established with every government department with an obligation to service its rural communities. Obvious departments would include Agriculture, Education, Health and Social Services/Development.

These departments could utilise and share the Connect Africa rural infrastructure to reach rural communities directly. Through economies of scale, direct service delivery to rural people can be achieved very cost effectively.

Voice and data communication infrastructure also allows for a two way information flow – something currently difficult to achieve in rural areas.

Different departments may require different levels of service delivery both in terms of scale and complexity. The scalability of the Connect Africa rural service network will be able to facilitate most ICT based service delivery while the routine service and maintenance schedule will be able to facilitate most physical service delivery requirements.

Furthermore, the ICT infrastructure itself offers officials in the field an opportunity to use and embrace e-government procedures on behalf of their rural constituents. Government departments will be able to reach their rural people directly and the rural people of Zambia will be able to reach their government without having to travel at considerable cost.

iv. Private Sector Business Service Delivery

The high cost/low return nature of conducting business in rural areas has limited the provision of and access to services in rural areas. An efficient and sustainable ICT-based service network, in which costs are shared across multiple service providers, offers a cost effective route to market for service providers. As with government service delivery, service levels facilitated by the Connect Africa network will be scalable and can be linked directly to demand.

Obvious commercial services include online or mobile banking, insurance, market research, utility payments, airtime sales, business services (CVs/letters/photocopying) and Internet and communication use training.

Product and service development partnerships can be mutually rewarding, allowing for a significant new market for many business service providers.

v. Sport and Entertainment

An ICT-based service delivery network in deep rural regions offers a unique opportunity for sport and entertainment broadcast services to

be delivered to these communities. The cost, service and maintenance of entertainment and sports broadcasting in deep rural areas resulted in very few rural communities enjoying the level of sport and entertainment that their urban and peri-urban counterparts do.

A routinely maintained and managed ICT infrastructure across rural areas can offer sport and entertainment service providers the means to reach new audiences while providing for the enjoyment of rural communities.

The service delivery network can in turn charge for the delivery, maintenance and monitoring of these services, thereby securing additional revenue streams to ensure sustainability. Direct access to rural communities with communication facilities will stimulate the establishment of physical sport and entertainment events in the rural areas.

The 2010 Soccer World Cup offers a host of opportunities and it is proposed that the district rollout in central Zambia be used as a showcase for what can be achieved when tournament organizers, broadcasters, sponsors, government and rural service providers cooperate to deliver a special event to rural communities. The provision of a rural fan park at each service centre should not be difficult to achieve.

vi. Social Enterprise

By registering the rural service network as a social enterprise, the usual criticisms of exploitative commercial entities profiting from the poor are obviated. The social enterprise business operates for profit with all profits being reinvested into the enterprise. This model provides the resources necessary to attract the best skills in the business and procure the best technology available, the combination of which ensures an efficient, professional and world class service. Commercial markets will not be threatened by discounted service charges being offered to a social enterprise serving only rural areas. Similarly government regulation and policy will not be undermined by

waivers and fee reductions. The social enterprise will be able to optimize the benefits of discounts and fee waivers to deliver the best possible service to rural communities.

8. Communication needs

It is clear from the rate of cellular service growth across Africa that there is significant demand for communication services in Africa. This trial project proves that there is as enthusiastic a demand in the rural areas as in the urban areas but much frustration with the lack of or low standard of rural communication services.

Rural areas still suffer from a lack of cellular coverage and this means rural areas with little or no service do not receive the benefits that communication infrastructure can bring. The problem is exacerbated by the speed at which urban and/or resource-rich regions, with access to services and communication infrastructure, are developing and widening the gap between urban and rural wealth creation.

Trial Project Experiences

Customer comments on the lack of available airtime on the PCO confirm the demand for the service.

A pre-paid management function, which cuts the call once the pre-paid amount is exhausted, was more popular than the call time period being controlled by the caller. In addition, the pre-paid option removes any dispute over payment, usually resulting from the caller having insufficient funds.

Dropped or misdialed calls at times resulted in a charge being incurred, resulting in further disputes. With the operator in charge of the dialing process, the number of these occurrences could be limited.

Calls to recipients in areas with poor cellular coverage were of poor quality and remains a challenge.

An interesting observation to note is that the cost of communication has resulted in the dispensing of traditional social etiquette. Phones in rural areas are rarely used for general chatting and traditional greetings are kept to a minimum.

Voice and SMStext message services are the primary services demanded by rural Zambians. Data services such as internet access are less in demand, largely due to a lack of access to such services and the resulting lack of experience. This will change as education and exposure to the technology improves.

As demand and communication needs grow, each Connect Africa service centre will be in a position to scale up with an appropriate and demand-led technology solution. In this way an optimised and sustainable communications network can be systematically built to suit customer needs.

9. Management & Logistics

The trial project was comprised of a core team of eight individuals with overall management being provided by Connect Africa's special projects director, Dion Jerling.

a. Project Team

i. Special Projects Director – Dion Jerling

Operating out of Johannesburg and Lusaka, Dion provided the overall management of the project guiding the local teams on the ground and securing the funding, services and technology for the project. Dion also assisted in presenting the project to government and other stakeholders.

ii. Country Project Coordinator – Dean Mulozi

Dean assumed overall responsibility for the project in Zambia. He managed the field coordinator and all management, administrative and stakeholder elements from Lusaka. Dean was instrumental in building the relationship with multiple government departments, in particular the Communications Authority and the Ministry of Agriculture.

iii. Regional Project Coordinator – Prince Lloyd Kabulwebulwe

Lloyd was responsible for managing the network of six operators at the six service points across the Kafue and Mumbwa region. Lloyd managed all aspects of the network, including liaison with the traditional

leadership in the region to appoint the operators, equipment installation, training, activity monitoring, cash management, market research, technical service and maintenance, and troubleshooting. Lloyd routinely visited the local service points weekly and outlying service points fortnightly. He reported regularly (at least twice a week) to Dean in Lusaka.

iv. Local Operators – Six appointed operators
The traditional leaders were instrumental in the appointment of the operators and in providing suitable accommodation for each PCO. The operators were responsible for manning and operating the PCOs on a daily basis. Customer service, manual record keeping, cash management and equipment maintenance were their primary responsibilities. They in turn reported to the regional project coordinator.

b. Reporting Structure

Each operator was responsible for on-site call data recording, which could then be reconciled with call data reports (CDRs) provided by the satellite network. These CDRs were essential to efficiently manage the cash flow, airtime top-up, and activity analysis for each service point. At any time an accurate picture of number of calls, destination of calls, time of calls and how much cash was at each service point could be determined. The operators were instructed to communicate any problems or requirements to the regional project coordinator.

The regional project coordinator was responsible for managing the six operators on the ground. The regional project coordinator's role was pivotal in the entire network and will ultimately take the role of district manager. With the key responsibility of cash management, service delivery and technical support for all operators in the region/district, it is this role that will determine the efficient and profitable running of the network. He in turn reported to the country project coordinator.

The country project coordinator was responsible for the overall running of the project in Zambia from administration to local logistics. Based out of Lusaka, he made regular visits to the project region approximately three hours drive west of the Capital. He reported to Connect Africa's special projects director and was responsible for submitting monthly progress reports and accounts summarising the project's progress.

Connect Africa's Special projects director was responsible for creating the project, raising the funding and then planning, deploying, monitoring and reporting on the project. Based out of Lusaka and Johannesburg he reports directly to the multiple stakeholders involved in the project.

c. Logistics

i. Vehicles

VW Transporter Crew Cab – Lusaka/Mumbwa
Land Rover Defender – Johannesburg/Lusaka/Project Locations
Suzuki 125cc off-road motorbike – Project Locations

ii. Staffing

Johannesburg:	Special Projects Director – Dion Jerling
Lusaka:	Special Projects Director – Dion Jerling
	Country Project Coordinator – Dean Mulozi
	CPC Assistant – Emma
Nalusanga:	Special Projects Director – Dion Jerling
	Regional Project Coordinator – Lloyd Kabulwebulwe
Service Points:	6 x Local Operators (Ref. Item 3 above)

iii. Activities

The special project director split his time between Johannesburg, Lusaka and the service locations in the field. Funding and infrastructure sourcing was carried out mainly in South Africa with government liaison and actual project management taking place in Lusaka. Infrastructure establishment, installation, training and maintenance was carried out on location in the field with the regional project coordinator.

The project headquarters, staffed by the country coordinator and his assistant are located in Lusaka. The majority of the country coordinators' time was taken up with government liaison, project reporting, accounting and regular visits to the project hub at Nalusanga.

The regional coordinator was based at the

Nalusanga Gate regional hub, sometimes operating out of the district capital of Mumbwa, 30km away to make use of the basic internet facilities available there. His time was spent visiting the six phone locations;weekly visits to the four nearest locations and fortnightly visits to the Chunga and TBZ over 200km away. In addition to technical, logistics, accounting, energy and people management, a significant amount of his time was also taken in regular meetings and updating traditional leaders and local government.

Local operators were recruited, trained and based in the selected locations (ref. Item 3 above). They were responsible for offering the service to the local people, promoting the service, maintaining a manual log of all call activity and managing the cash received for the calls.

10. Conclusions

Project Objectives

i. Overall Objective

This report details the project results which support the proposal to roll-out a series of service centre modules (one module consists of 20 service centres) across at least one district in Zambia. The government and other stakeholders have already indicated their interest in and support of the project and the proposed recommendation. The overall objective of this project – to ultimately enable Zambia to provide a model for rural service delivery for the rest of Africa – has been particularly well received.

ii. Technology

The Thuraya PCO offered a high quality call at a competitive rate. It withstood a robust environment and more motion than was recommended. However, the lack of call data reports from the Thuraya network during the project was a major problem, making the management of the rural network significantly less efficient. This problem has since been resolved and the issue served to highlight the importance of call data being provided on time.

Call charges have a direct impact on the sustainability of a rural communication network and will form a key element of our recommendations.

The trial findings also reveal that there is demand for data services in some rural areas, but the cost of providing data services sustainably will

need to be offset by charges to public and private sector service providers for the delivery of their value added services.

iii. User Response

Call data analysis has outlined user activity and trends. The high volume call spikes coinciding with the time when airtime was loaded onto the community phones clearly demonstrates the underlying demand for communication services in these rural areas.

The consistent feedback on the lack of airtime on the community phones further proves the unsatisfied demand and need for communication infrastructure in rural regions.

The fact that these results were achieved in regions with reasonable access to Mumbwa would suggest that we can expect stronger demand for communication services from deeper rural communities who currently have to spend more to travel to a point where they are able to make calls. .

iv. Commercial Viability

Demand for a pay-phone communication service has been proved by the call volumes and frequency achieved during the trial. The call rates were considered acceptable when matched with those of the cellular market, but relying on call revenue alone is not sustainable. The profit margin on call revenue has to be sufficient to cover all infrastructure, network, service and maintenance costs. The high cost of satellite calls will require excessive call charges being passed on to rural customers unless reduced call rates can be negotiated with the networks and/or subsidies are secured from government.

v. Management and Logistics

The concept of a three-tiered management system – country hub/regional hub/village service point - with a two-way flow of information between each tier was proven to be an optimum model. The regional hub contains the critical path in terms of network management, service and maintenance.

Routine and trusted service support in the field is essential for the efficient operation of the communication and service delivery infrastructure. Efficient and timely cash management is essential for sustainability, as well as for maintaining and improving ongoing service levels.

Transport challenges and requirements were highlighted and an all season, all terrain solution has been proposed in the roll-out recommendation.

11. Some Lessons Learnt

The trial project provided some useful lessons and insights into the sustainability, operational and service requirements of rural service delivery.

a. Sustainability

- Facilitating the organic growth of a local service solution is critical to ensure project sustainability. The final service provision has to be demand led.
- To ensure sustainability, the high cost of satellite calls will require a subsidy and/or multiple additional revenue streams.
- Stakeholder investment in the communication infrastructure will be instrumental in ensuring sustainability.
- Non-proprietary communication infrastructure will ensure aggressive network charge negotiations in favour of the rural network with resulting cost reductions.
- Connect Africa's social enterprise status encourages government and development support and funding, but may discourage commercial investment capital funding. A hybrid organisational structure with an efficient loan capital management strategy would enable Connect Africa to enjoy the benefits of both a commercial and a social enterprise.
- Incoming calls generate no revenue for the operator or rural service network and block the line for revenue generating outgoing calls. This problem is partially offset by the excessively high cost of calling a satellite phone which dissuades people from calling in. Service centre - to - service centre call charges are however more reasonable and this offers an opportunity for specific Connect Africa calling points to be established in urban areas offering low cost calls to the rural service centres. Revenue is then generated on most incoming calls.

b. Service

- A communication network will be instrumental in the delivery of electricity, cellular and data services to rural communities and it is critical that the network benefits financially from facilitating the delivery of such services.

- A communication service provided within an official government owned facility such as in Chunga Camp in the Kafue National Park offers an opportunity to provide official communication services for that official or government entity. Accurate recording of all official communication activity is essential to differentiate between official and public services that might have different charging structures.
- SMS functionality on the pay-phone will open multiple new, affordable and enterprising communication opportunities for rural people from banking to information delivery.
- Cellular banking type services are a significant opportunity for such a network – assuming the security level requirements, usually centered on personal SIM cards, are met. The ability to facilitate cash transfers will in effect enable each pay-phone to operate as an ATM in deep rural areas.
- Privacy while making a call is an issue for many people. A private booth is best for the caller, but not practical for the operator, who needs a public space for management and control. A balance will have to be established.
- The routine visit by field technicians to service locations in the field provides an opportunity for Connect Africa to physically deliver multiple additional services to deep rural communities. From energy and information to entertainment and learning, the opportunities for service delivery are endless. This service element will form the basis of Connect Africa's added value service offering.
- Calls which are automatically terminated (with reasonable warning) when the call time purchased has been used will prevent post call disputes and the risk of callers extending calls beyond what they have the ability to pay for.
- Every effort should be made to keep track of all new technology innovations, successfully used elsewhere, to integrate them into the Connect Africa network.
- The training of the field technicians will need to be comprehensive, and it must cover multiple skill sets from technical support and maintenance to business development and customer service.
- Unlike all other network service providers, Connect Africa's role is uniquely focused on rural service delivery, with its core business being a specialist in rural logistics. Connect Africa simply facilitates the distribution and delivery of multiple service providers' own services and technology.

- A district hub should be adequately equipped and resourced to be able to provide a high level of service to the residents of the host town, in addition to the rural region it manages.

c. Operations

- The physical security of the communication infrastructure is not limited to location and positioning only. There is the risk of unauthorized use of the network if the operator is not present. Security log-ins and routine call data analysis and reconciliation must be carried out to prevent unauthorized use. A secure location is imperative to prevent the infrastructure from being stolen or damaged. A strong relationship with the traditional leadership of the area may deter theft and vandalism.

- Antennas fixed on or near roofs in deep rural locations are at risk of damage by wild animals, in particular, baboons and monkeys. Ideally a standalone pole should be used for the antenna. Lightning damage?
- The service contract for field operators should not limit their opportunity to earn revenue but should also not create unrealistic expectations.
- Airtime credit needs to be routinely checked and a top-up request submitted well in advance of the airtime being exhausted. Ideally the phone units will have a setting or alarm notifying both the operator and regional hub of the need for a top-up. A program could be inserted into the daily call data report analysis to flag airtime requirements.
- Storage and the installation location of any equipment should be considered for insect infestation which can permanently damage the highly sensitive satellite equipment.
- Upon each installation of a service point, a period of time is required to manage the inevitable teething problems such as bug infestations, airtime issues, technical faults etc. prior to publically launching the service.
- Comprehensive training and assessment of the operators is key to ensuring the best possible service experience for both the operator and

the customer. The careful selection process for operators should not be compromised by inadequate training.

- The phone units must be able to accommodate local currency denominations. Using a dollar-based charging system standardizes the system but there is usually a problem with not enough zero digits to accommodate local currency numbers.
- A reliable and sustainable power supply is essential to the success of any technical service offering in rural areas. It is critical that power levels are constantly monitored and maintained with sufficient basic spares and recharge facilities close at hand to prevent any down time.
- The daily monitoring, analysis and interpretation of the call data reports (CDR) for each service centre is imperative to ensure the maintenance of accurate and efficient service levels.
- The satellite equipment we used, albeit robust, was sensitive to excessive movement, as with all satellite equipment. It is imperative that transport and installation is carefully done with enough (generous) time allowed for each installation.
- Operator remuneration has to be carefully structured to ensure loyalty, efficiency and motivation. Operators will own their own business, but multiple service centre owners will need to structure a basic wage and commission for their operators.
- An efficient and comprehensive equipment management system will need to be established to manage and coordinate the deployment, maintenance and return of any equipment. This will form a critical element of the logistics operation.
- A comprehensive, locally developed marketing strategy should be coordinated and integrated into a regional (district) and national marketing strategy.
- A suitable work surface and storage facility (padded secure containers) must be supplied for the equipment. A secure cash box must also be supplied for the operators.
- A sense of value for the equipment and the services themselves needs to be instilled into all operators to ensure equipment and service levels are maintained.

12. Recommendations

The success of the trial project has clearly demonstrated the demand for rural communication services in Zambia.

The technology is available and scalable to meet the evolving needs of rural people. Key to the success of any rural service delivery network will be the logistics, management and maintenance of the infrastructure and service levels on a sustainable basis.

It is clear from the trial that communications services alone will not sustain a rural network and revenue has to be generated from the delivery of multiple value added services delivered on behalf of public and private sector service providers.

These service providers will not be able to engage with Connect Africa unless there are a sufficient number of service centres reaching a large enough area with a critical mass of people.

It is recommended that a comprehensive service network offering data and voice services on different technology platforms be established across at least one full district in Zambia.

It is proposed that this district network be monitored, managed and enhanced over a period of twelve months until an optimum network and service structure is established.

This district network will then serve as a model to be replicated across all seventy two districts in Zambia, and Zambia will in turn provide a country model for the rest of Africa and beyond.

This recommendation along with a funding proposal to the Universal Access Fund is detailed in the accompanying “Proposal for District Service Network”.

13. Appendices

Period over which data received

Village	Period	Phone	Days
Chunga Camp (Kafue National Park)	02/03/2009 - 17/06/2009	PCO	105
Makunku Village	02/03/2009 - 02/06/2009	PCO	90
Mukokomena Village	01/07/2008 - 10/01/2009	Iridium	189
Nakanjori Village	03/03/2009 - 11/06/2009	PCO	98
Nalusanga Gate	01/03/2009 - 08/04/2009	PCO	37
Tobacco Board of Zambia (TBZ)	01/03/2009 - 31/05/2009	PCO	90

Number of calls per village

Village	No of calls	Duration (s)	Avg (s)	Amount (USD)
Chunga Camp (Kafue National Park)	427	26,821.00	62.81	**$279.05**
Makunku Village	358	12,376.00	34.57	**$165.00**
Mukokomena Village	256	12,260.00	47.89	
Nakanjori Village	149	5,852.00	39.28	**$61.70**
Nalusanga Gate	280	14,711.00	52.54	**$159.15**
Tobacco Board of Zambia (TBZ)	628	40,566.00	64.60	**$398.33**
Total	**2,098**	**112,586.00**	**50.28**	**1,063.23**

Max calls per village on a single day

Village	Max No of Calls	Date
Chunga Camp (Kafue National Park)	35	06/03/2009
Makunku Village	30	18/03/2009
Mukokomena Village	22	02/01/2009
Nakanjori Village	28	17/04/2009
Nalusanga Gate	44	08/03/2009
Tobacco Board of Zambia (TBZ)	84	27/03/2009

Max duration of calls per village on a single day

Village	Date	Max Duration	No of Calls	Avg (s)
Chunga Camp (Kafue National Park)	06/03/2009	1,762	35	50.34
Makunku Village	20/03/2009	938	23	40.78
Mukokomena Village	13/11/2008	1,082	12	90.17
Nakanjori Village	27/04/2009	1,007	8	125.88
Nalusanga Gate	08/03/2009	2,716	44	61.73
Tobacco Board of Zambia (TBZ)	04/04/2009	5,426	69	78.64

Max duration of single call per village

Village	Date	Max Duration	Called Location
Chunga Camp (Kafue National Park)	24/03/2009	548	Zambia
Makunku Village	03/03/2009	176	Zambia (Celtel / Zain)
Mukokomena Village	01/09/2008	292	Zambia (Celtel / Zain)
Nakanjori Village	27/04/2009	634	Zambia (Celtel / Zain)
Nalusanga Gate	11/03/2009	484	Zambia (Celtel / Zain)
Tobacco Board of Zambia (TBZ)	04/04/2009	503	Zambia (Celtel / Zain)

Number of calls per week band

Originatinglocation	Week 1	%	Week 2	%	Week 3	%	Week 4	%	Total
Chunga Camp (Kafue National Park)	137	21%	111	20%	74	19%	105	22%	**427**
Makunku Village	98	15%	96	17%	112	29%	52	11%	**358**
Mukokomena Village	93	14%	65	12%	31	8%	67	14%	**256**
Nakanjori Village	41	6%	35	6%	51	13%	22	5%	**149**
Nalusanga Gate	23	3%	147	26%	110	28%		0%	**280**
Tobacco Board of Zambia (TBZ)	268	41%	108	19%	12	3%	240	49%	**628**
Total	**660**	**31%**	**562**	**27%**	**390**	**19%**	**486**	**23%**	**2,098**

Percentage of calls made in the first month

Originatinglocation	Calls in 1st month	Total calls	Percentage
Iridium (Mukokomena Village)	25	256	10%
Thuraya PCO	1219	1842	66%
Total	**1244**	**2098**	

Number of calls per country (excl inter-villages)

Originatinglocation	Comoros/ Mayotte Island	Czech Republic	Malaysia	Satellite misdial	South Africa	United Arab Emirates	United States	Zambia	Zambia Misdial	Total
Chunga Camp (Kafue National Park)		4		1		3		416		**424**
Makunku Village				2				352	1	**355**
Mukokomena Village			1		3		5	247		**256**
Nakanjori Village				32				107		**139**
Nalusanga Gate				8	1			266		**275**
Tobacco Board of Zambia (TBZ)	1			18	1			606		**626**
Total	**1**	**4**	**1**	**61**	**5**	**3**	**5**	**1,994**	**1**	**2,075**

Number of calls between villages

Originatinglocation	Chunga Camp (Kafue National Park)	Makunku Village	Nakanjori Village	Nalusanga Gate	Tobacco Board of Zambia (TBZ)	Total
Chunga Camp (Kafue National Park)				3		**3**
Makunku Village			1		2	**3**
Mukokomena Village						**-**
Nakanjori Village	7			3		**10**
Nalusanga Gate		2	2		1	**5**
Tobacco Board of Zambia (TBZ)	2					**2**
Total	**9**	**2**	**3**	**6**	**3**	**23**

Percentage of total airtime utilized per week

Week/Village	Chunga Camp (Kafue National Park)	%	Makunku Village	%	Mukokomena Village	%	Nakanjori Village	%	Nalusanga Gate	%	Tobacco Board of Zambia (TBZ)	%
Week 1	$105.91	**38%**	$45.65	**28%**		**0%**	$16.22	**26%**	$9.78	**6%**	$166.53	**42%**
Week 2	$58.33	**21%**	$42.32	**26%**		**0%**	$17.37	**28%**	$88.92	**56%**	$68.26	**17%**
Week 3	$40.57	**15%**	$51.87	**31%**		**0%**	$11.90	**19%**	$60.45	**38%**	$6.24	**2%**
Week 4	$74.24	**27%**	$25.16	**15%**		**0%**	$16.21	**26%**		**0%**	$157.30	**39%**
Total	**$279.05**	**100%**	**$165.00**	**100%**		**0%**	**$61.70**	**100%**	**$159.15**	**100%**	**$398.33**	**100%**