Nepal

後発開発途上国
通信が時空を超える

Mr. Mahabir Pun

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Japan International ICT Association （JIIA）

http://jiianet.com

塩尻市

前駐日ネパール
特命全権大使

ガネシュ・ヨンザン・
タマン閣下

Asia-Pacific Telecommunity

APT is one of the key organizations of governments, spearheading development and innovation programs in cooperation with telecom service providers, manufacturers of communication equipment and research and development organizations in the field of Communications and Information Technology. APT serves member countries on ICT in the Asia Pacific Region.

ITU International Telecommunication Union

ネパール連邦民主共和国概要

- 人口　約３０００万人
- 産業　GDP比率
　　　農業: 38%，　鉱工業: 20%，　サービス業: 42%（2005年）

　　　海外への出稼ぎによる外貨収入が大
- GDP　２０１３年　１９３億ドル
- 一人当たりGDP　643ドル
- 識字率　５０％
- 国連から後発開発途上国指定
- 高低差　７０ｍ(インド側）～８８４８ｍ（エベレスト）

Detail Network Diagram

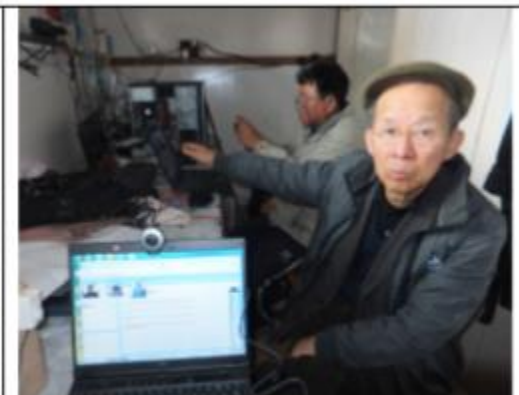**Wireless Network Diagram of Nepal Wireless Networking Project – April, 2012**

APT J2 2011

・塩尻市の無線ネットワークシステムの説明
・Wi−Fiネットワーク設備の増設
・マルチテレビ会議システムの開発
・遠隔医療（テレメディスン）
・山岳地域の小中学校でのコンピュータ教育
・山岳地域での農業指導
・ネパール総務省と通信インフラについて協議
・駐日タマン大使一行の塩尻市訪問

Japanese and Nepali Team at ENRD office

Testing OpenMeeting in Nangi

Nepali Ambassador with Japanese team

Meeting at Shiojiri tomato farm with Ambassador

Meeting with the Chairman of Nepal Telecommunication Authority

Meeting with the Managing Director at Nepal Telecom

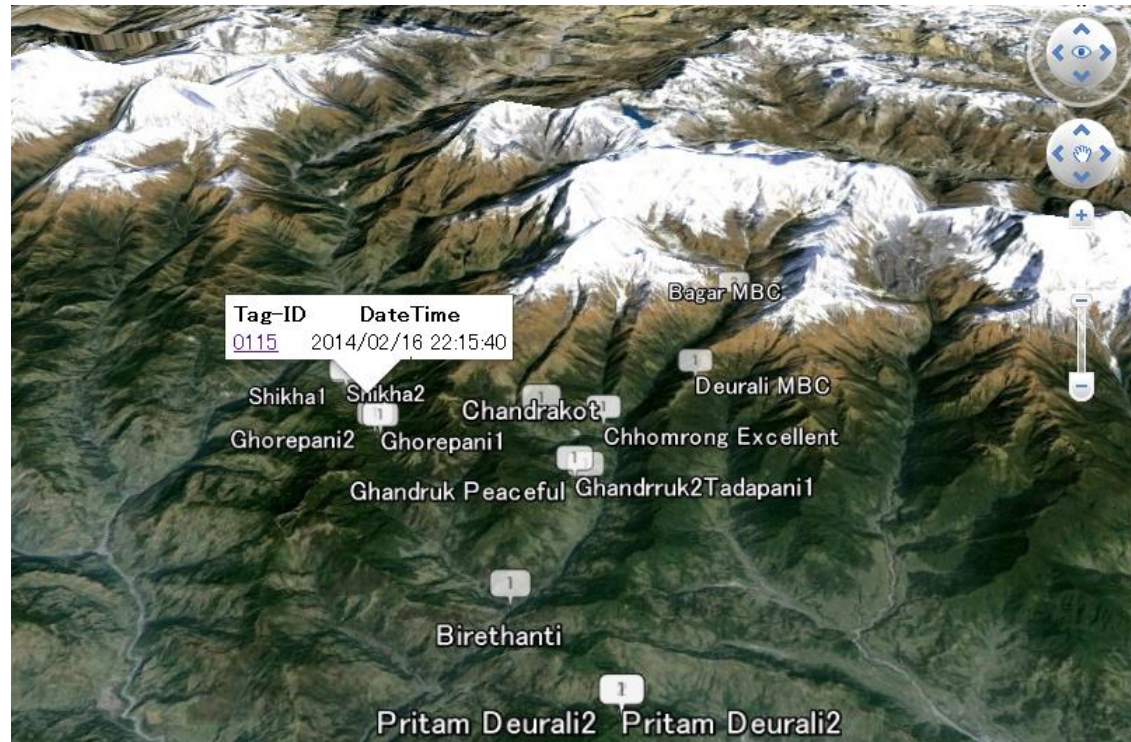Project team at a formal meeting in MoIC, Nepal with Secretary and high level officers

SATRC　30 July-1 August 2013

南アジア通信協議会の会議

APT J3 2014

・１０村にインターネットセンターの増設
　Bandok、Niskot、Okhareni、Khopra、Tolk、Paudwar、Tikot、Lespar、Aula、Ｎａｎgi

・トレッカートラッキングシステムの導入
　アンナプルナ山岳地帯9村にゲートウェイを設置し15台のセンサーを設置
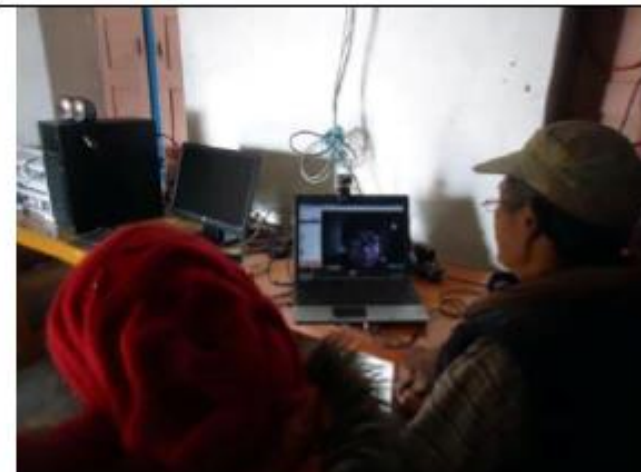
10の村にインターネットセンターの増設

Solar Panel Installation in Paudwar village

Solar panel Installation in Tikot village

Solar panel installation in Aula village

Internet Center in Aula village

Internet Center in Nangi

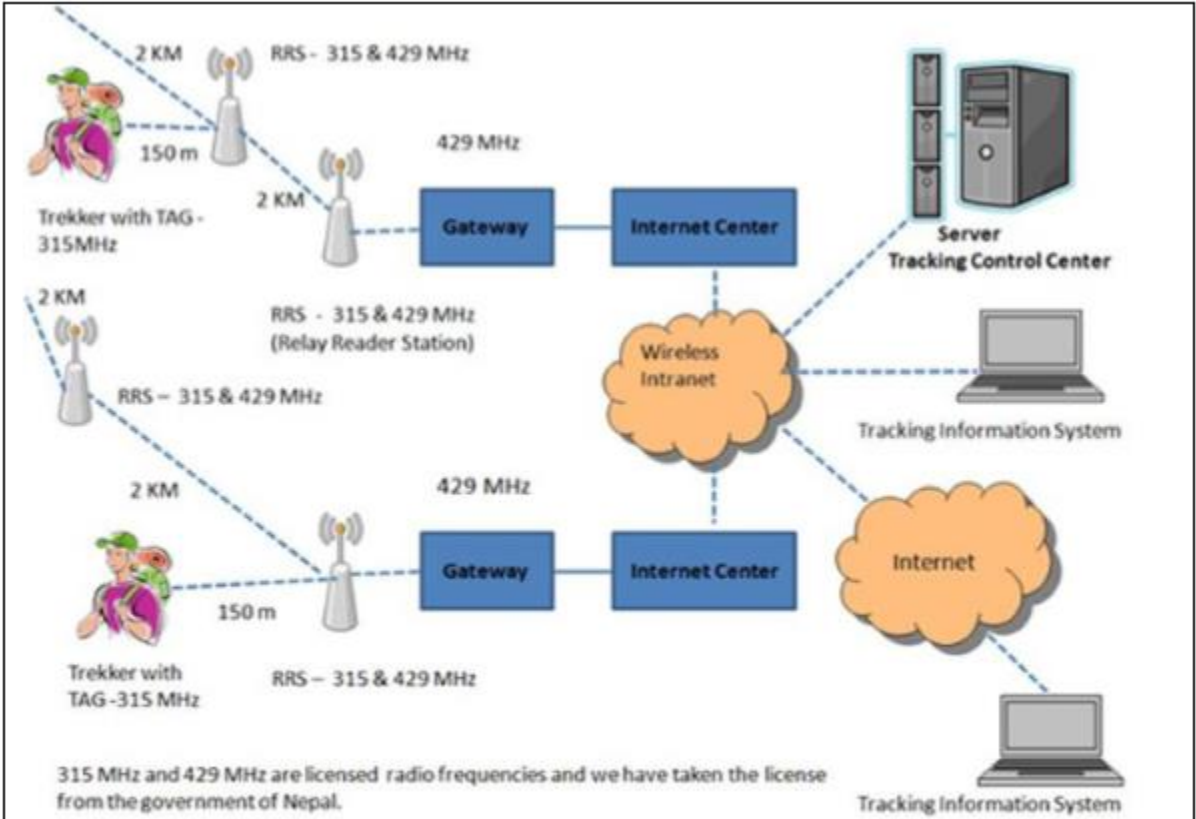Internet Center in Tikot village

Solar Installation in OkhareniVillage

Internet Center in Okhareni village

トレッカートラッキングシステムの導入

Setting up wireless link in Machhapuchhre region and Darbang region

2 KM — RRS - 315 & 429 MHz
150 m
2 KM
Trekker with TAG - 315MHz
429 MHz
Gateway — Internet Center
Server Tracking Control Center
2 KM
RRS - 315 & 429 MHz (Relay Reader Station)
RRS – 315 & 429 MHz
Wireless Intranet
Tracking Information System
2 KM
429 MHz
150 m
Gateway — Internet Center
Internet
Trekker with TAG -315 MHz
RRS – 315 & 429 MHz
Tracking Information System
315 MHz and 429 MHz are licensed radio frequencies and we have taken the license from the government of Nepal.
This is the schematic diagram showing how the trekker tracking system works.

Repeater Relay Station Powered by Solar

SOS   eID
eTag for the Trekkers and the battery

RRS installed in Ghandruk

RRS installed in Chhomrong

少し休憩　ネパールってこんなところ

地震

12.Nov カトマンズ市内の地震被害地視察
寺院壁など崩壊　　　　　　　　世界遺産　屋根・壁崩壊、木材で倒壊防止

地震前の宮殿建築物 Sep. 2011

地震後の宮殿建築物 Nov. 2016

APT EBC カテゴリーJ3採択案件（2015年分）

ネパール： 地震で被災したゴルカ郡（Gorakha District）の16村におけるコミュニティの学校と保健診療所を接続するための、周波数割当のない帯域のWi-Fi、VHF帯のTVホワイトスペースを地勢に応じて組み合わせて使用するスマート・ルーラル・ブロードバンド・ネットワークの構築並びにWi-Fi拠点、非常時通信システム及び早期警報システムの設置を行うパイロットプロジェクト

Pilot Project for Establishment of Smart Rural Broadband Network Using a Combination of Unlicensed Wi'Fi, VHF and TV White Space Bands Depending Upon the Geographical Terrains in 16 Villages of Earthquake Affected Gorakha District of Nepal to Connect Community Schools, and Health Clinics and Build Wi-Fi Hotspots, Emergency Communication System and Early Warning System for the Villagers

概要

ネパールのダルチャラ郡の5村のﾃﾚｾﾝﾀｰ間のﾈｯﾄﾜｰｸを構築するため、無線ﾌﾞﾛｰﾄﾞﾊﾞﾝﾄﾞを活用し（ホワイトスペース技術等を活用。）、10の学校及び5つの病院でインターネットサービスが利用可能となるように整備し、教育や医療改善に役立てるもの。

実施メンバー

先方： ENRD,Technology Sales Pvt. Ltd, Nepal Wireless, Gham Power Company Pvt. Ltd,
日本側協力機関：日本ITU協会, KDDI, (株)日立国際電気, 野村エンジニアリング(有)、日本ソフトウェアエンジニアリング(株)

### 採択金額

198,966USD

実施期間

8ヶ月（2016年2月～2016年10月）

プログラム実施により期待される主な成果

・　16のWi-Fi拠点を構築し、10の学校、5つの診療所へのインターネット
　　接続。
・　電子図書館への接続
・　早期警報システム（10校）及び地滑り警報システム（2村）の構築

横展開の可能性、終了後の取組予定

・VHF帯・UHF帯の空き周波数を活用した本通信システム（TVWS）は、地理的条件の影響を受けにくく、ルーラル地域のデジタル・ディバイド対策に有効であり、本件の実証結果は、近隣諸国への展開が期待できる。
・インフラ整備のみでなく、ICT利活用にも焦点をあてていることから、その後の持続的な活用も見込まれる。

システム概要図

Wireless Network Supported by APT J3 in Nepal 2016
By Girish-NepalWireless 3 Jan 2016
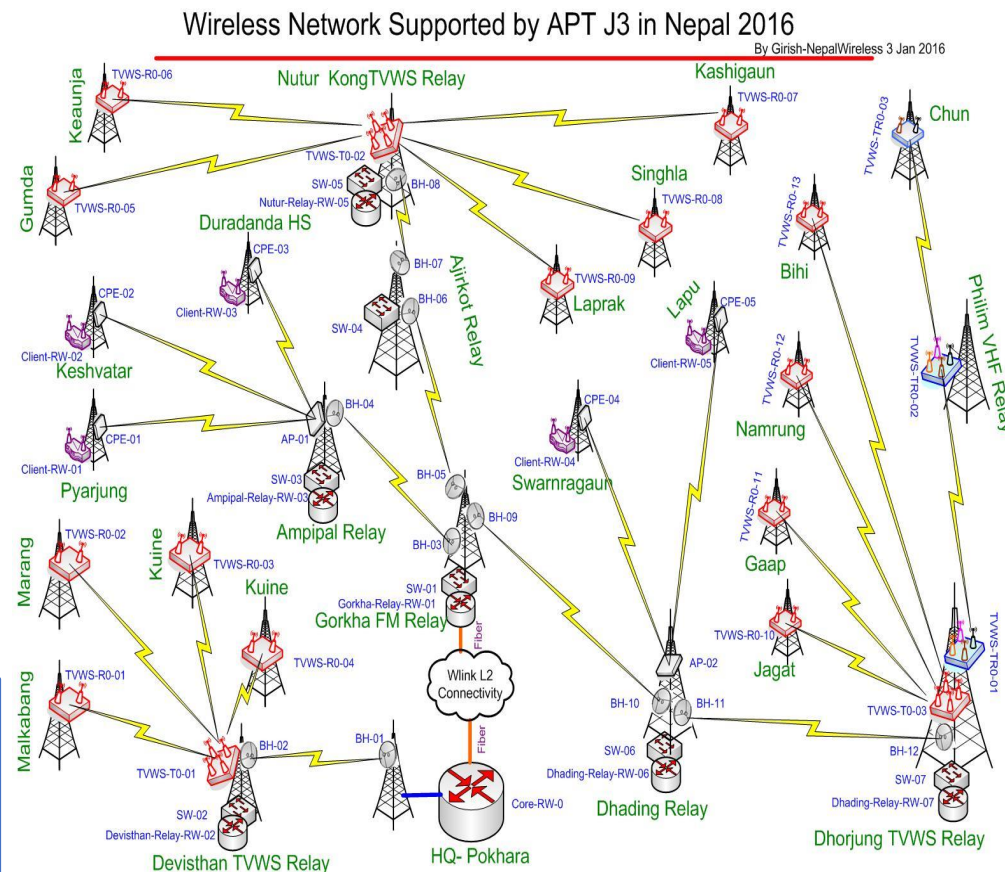
APT J3 2016

地震で被災したゴルカ郡（Gorakha District）の16村におけるコミュニティの学校と保健診療所を接続するための、周波数割当のない帯域のWi-Fi、VHF帯のTVホワイトスペースを地勢に応じて組み合わせて使用するスマート・ルーラル・ブロードバンド・ネットワークの構築並びにWi-Fi拠点、非常時通信システム及び早期警報システムの設置を行うパイロットプロジェクト

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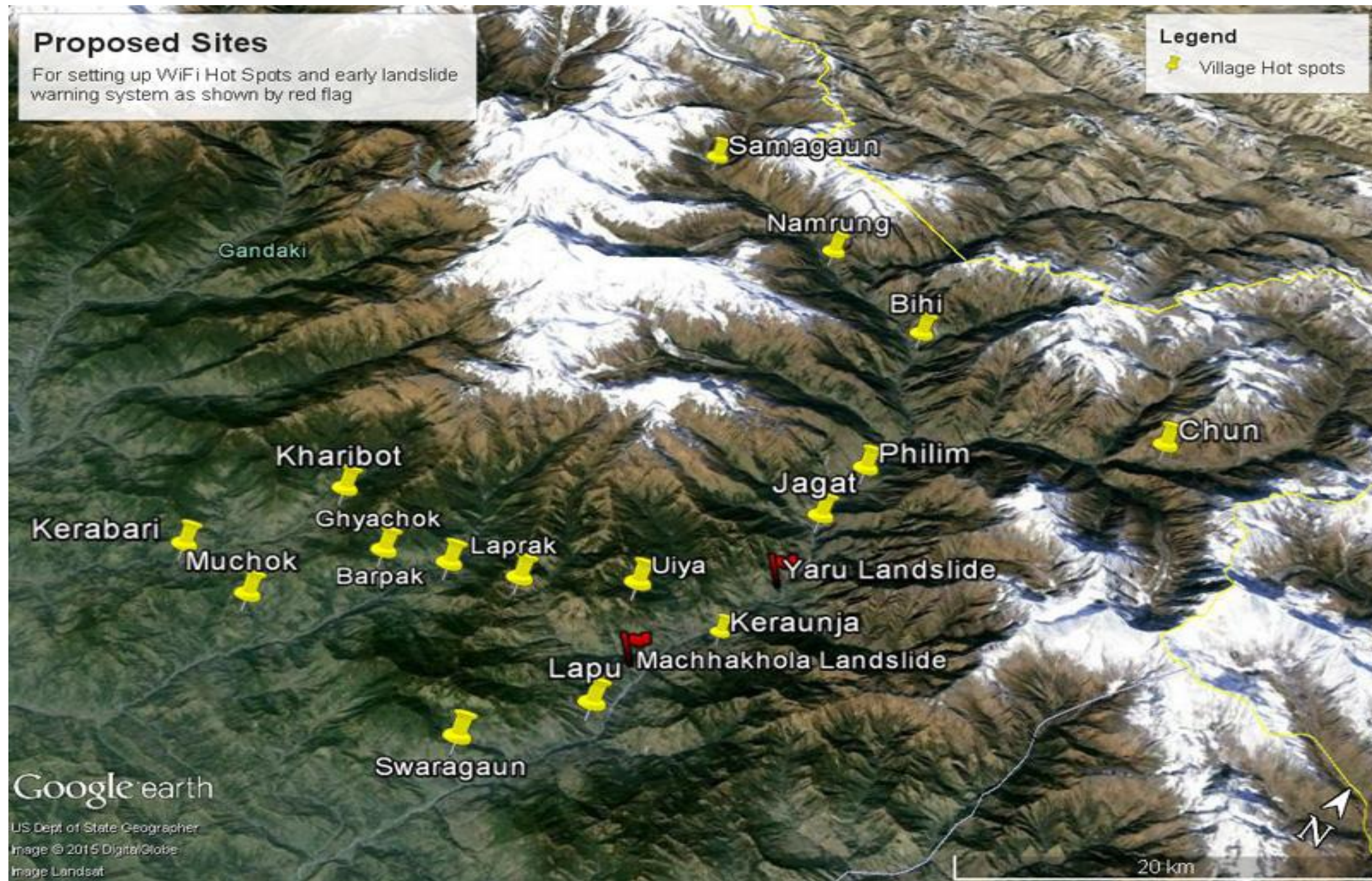
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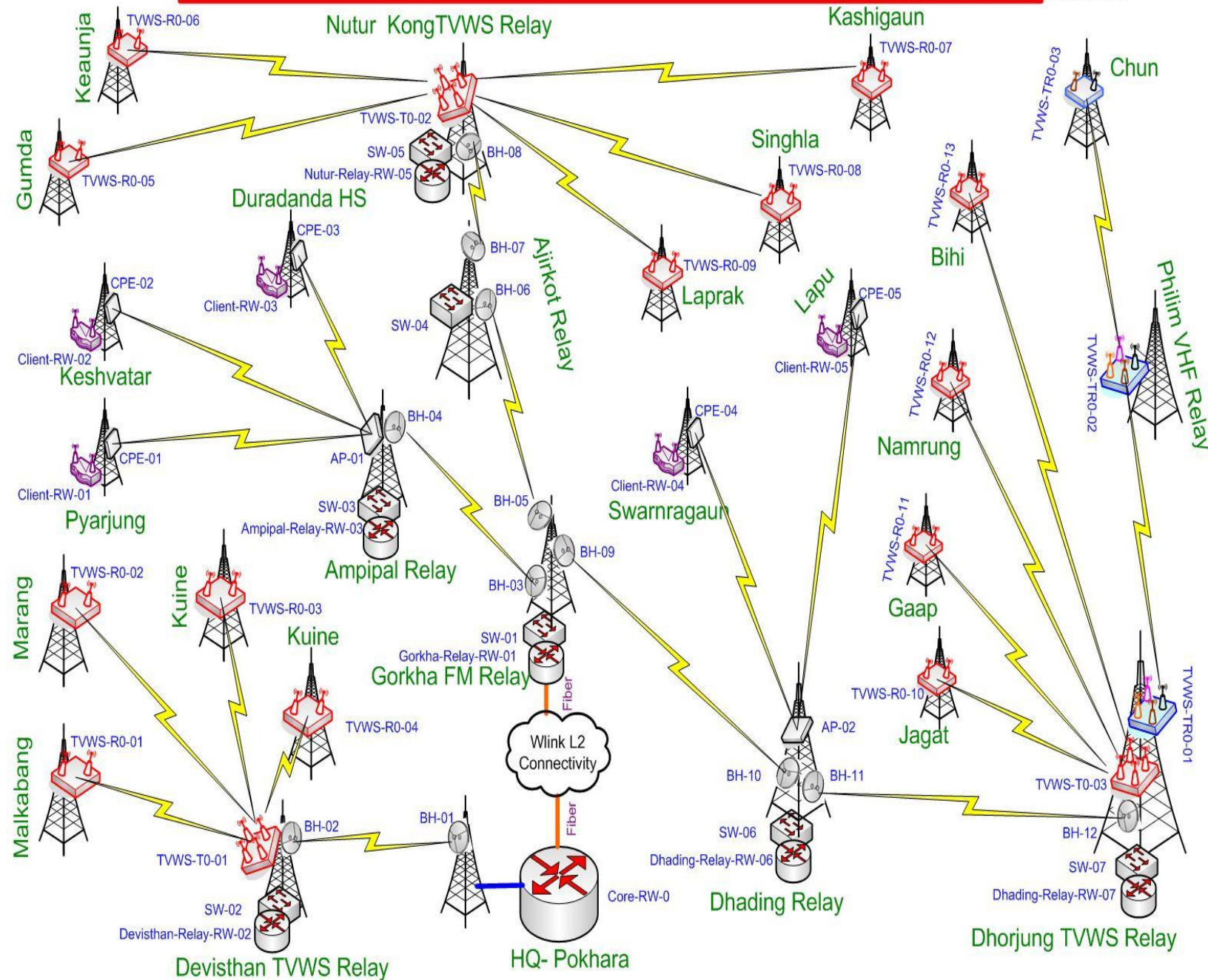
Proposed Sites
For setting up WiFi Hot Spots and early landslide warning system as shown by red flag

Legend
Village Hot spots

Problem#1:
Wi-Fi signals are blocked by mountains, trees and buildings.

Solution:
Build hybrid wireless network using a combination of Wi-Fi, TVWS and VHF technologies.

Technology Used & Radio Frequencies

- Wi-Fi Frequencies: 2.4 GHz for Hotspots, 5.8 GHz for Point to Point Backhaul Link
- TVWS Frequencies Used: 460 MHz to 478 MHz
- VHF Frequencies Used: 192.5 MHz to 202.5 MHz

Permission to use the TVWS and VHF frequencies were received from the Government of Nepal

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TVWS Equipment Available in the Market

- Carlson Wireless Technologies (http://www.carlsonwireless.com/)
- 6harmonics (http://6harmonics.com/),
- Doodlelab (http://www.doodlelabs.com/products/licensed-band-radio-transceivers)
- Adaptrum (http://www.adaptrum.com/)
- Saankhya Labs (http://www.saankhyalabs.com/products/white-space-base-station)

TVWS Equipment Used for the Pilot

- RuralConnect Gen 2 devices made by Carlson Wireless Technologies USA.

- Supposed to work in non line of sight and near line of sight environment, and areas with thick foliage.

- Coverage - 10 KM radius.

For more information visit: http://www.carlsonwireless.com/products/

Testing in Rugged Mountain Environment
TVWS Base Station in Gorakha

Testing in Flat Plain Environment
TVWS Base Stations in Janakpur

Testing in City Environment
TVWS Base Stations in Kathmandu

Hitachi Kokusai Electric

VHF Band − 192.5 MHz to 202.5 MHz

- Lower interference risk
- Long-range propagation - 20 KM Point to Point Link.
- Non- line-of-sight communication with excellent diffraction ability
- **For more information visit and contact:**
- http://www.hitachi-kokusai.co.jp/global/en/index.html

(PRODUCT IS NOT DISCLOSED SO FAR)

Altitude Profile

Distance：Approx.15km
Difference in elevation ：1,000m

Non line of sight communication is required!
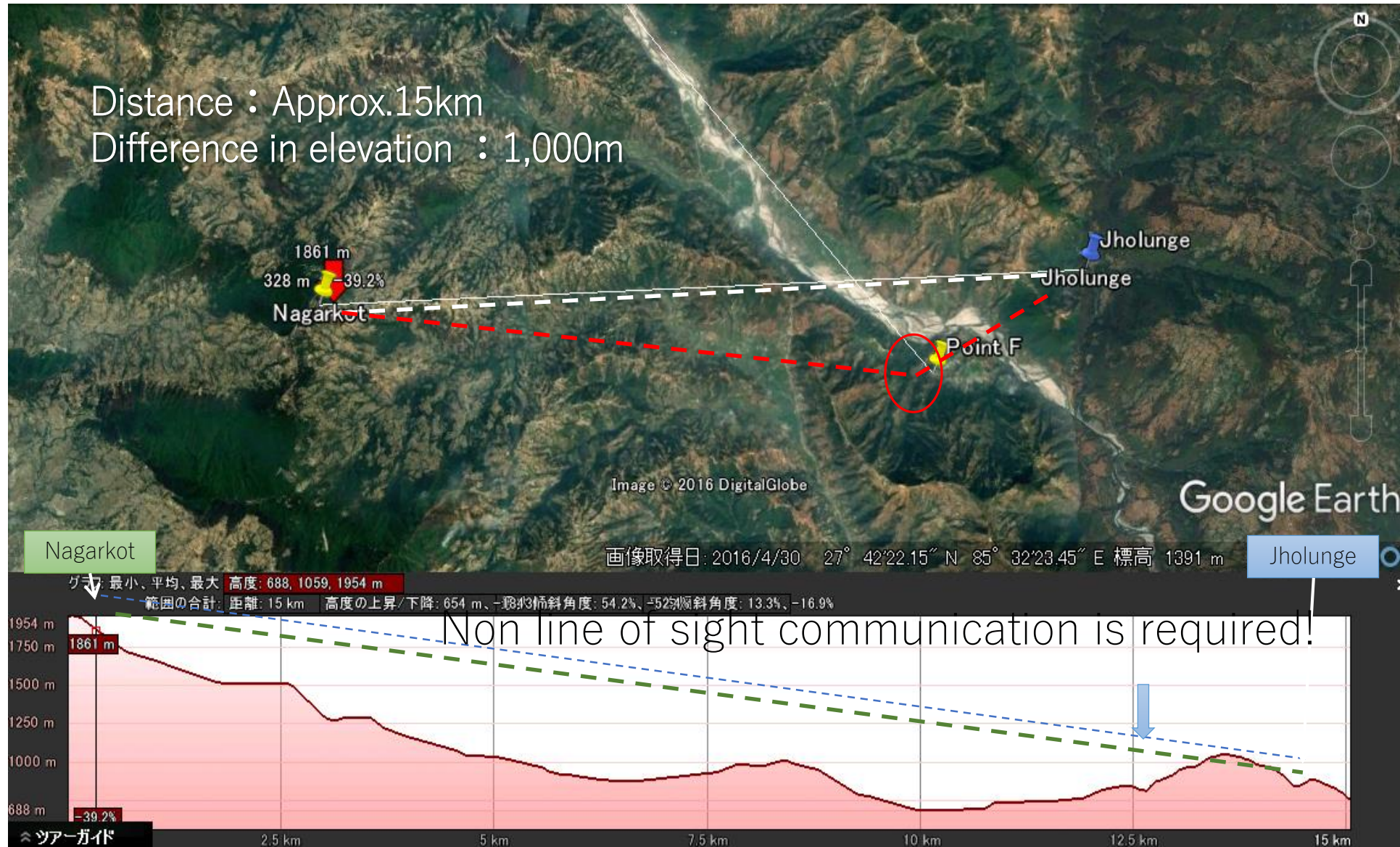
VHF Transmitter at Nagarkot and Receiver at Jholunge
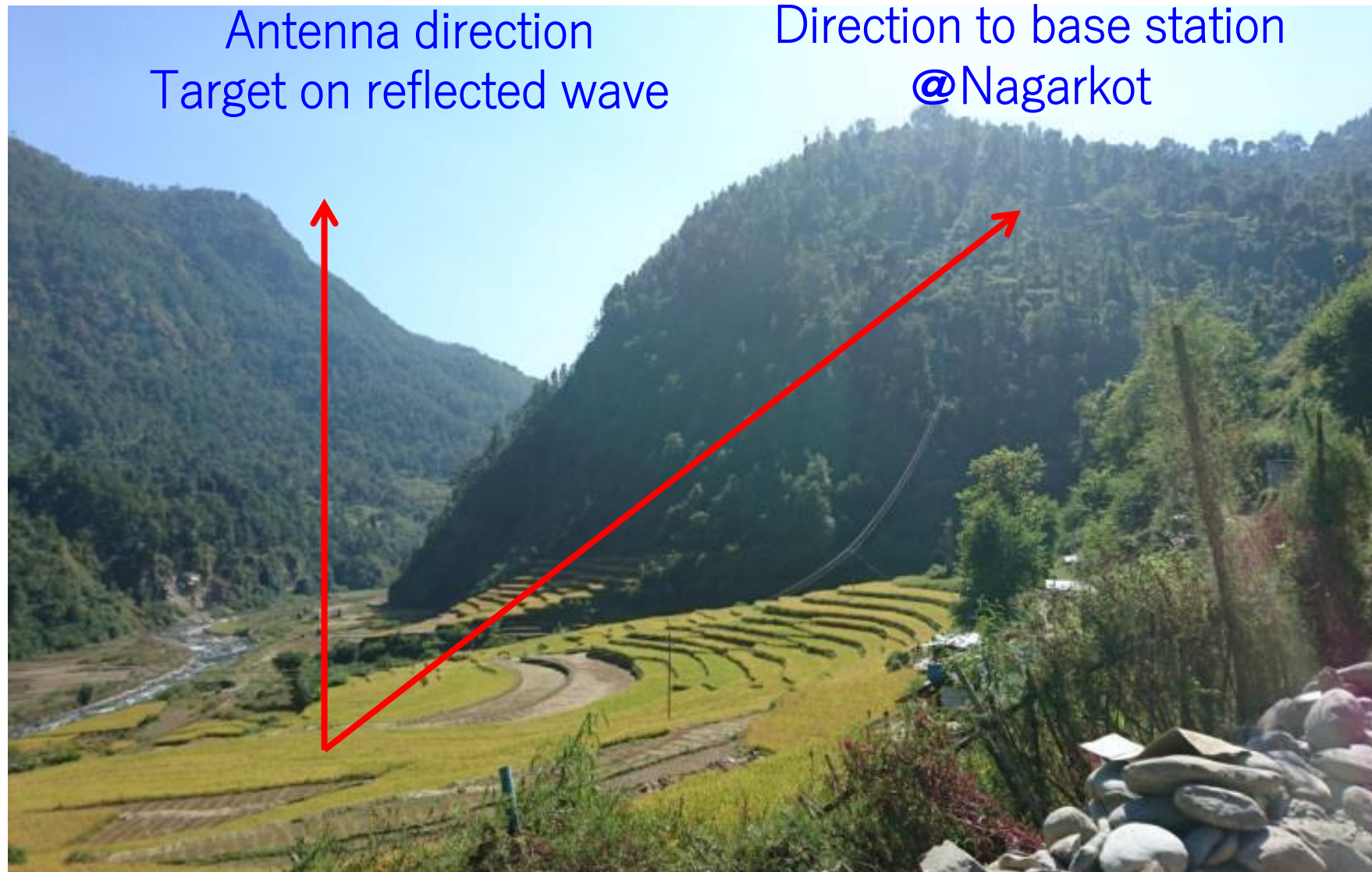
Rural station@ Jholunge （Cont'd）

■Setting internet connection

■Welcome Party

Internet was connected to elementary school in Jholunge

Rural Station@ Jholunge

Problem #2:
Every year some trekkers get lost in the mountains and some of them are never found.

Solution:
Use Trekker Tracking System. It can also be used for tracking school children and elderly people in the urban areas as well.

Tracking System Relay and Weather Station

Annapurna Base Camp Region, Nepal

Trekker Tracking System at Annapurna

Problem #3: Many lead-acid batteries are used in Nepal and all over the world, but there are very few engineers who have knowledge in lead-acid batteries.

Solution: Use battery regeneration system properly to extend the life of batteries.

Installation of Battery Regeneration System
& Lectures of How to regenerate old lead-acid batteries

Takeshi Kawabe, Hiroshi Tominaga

Japan Battery Regeneration, Inc.

http://www.jpn-bat.com

Japan Battery Regeneration,Inc.

Information about the Additive Used in Battery Regeneration Technology

Super-K Patented Lead-acid Battery Additive

P type Super-K activator
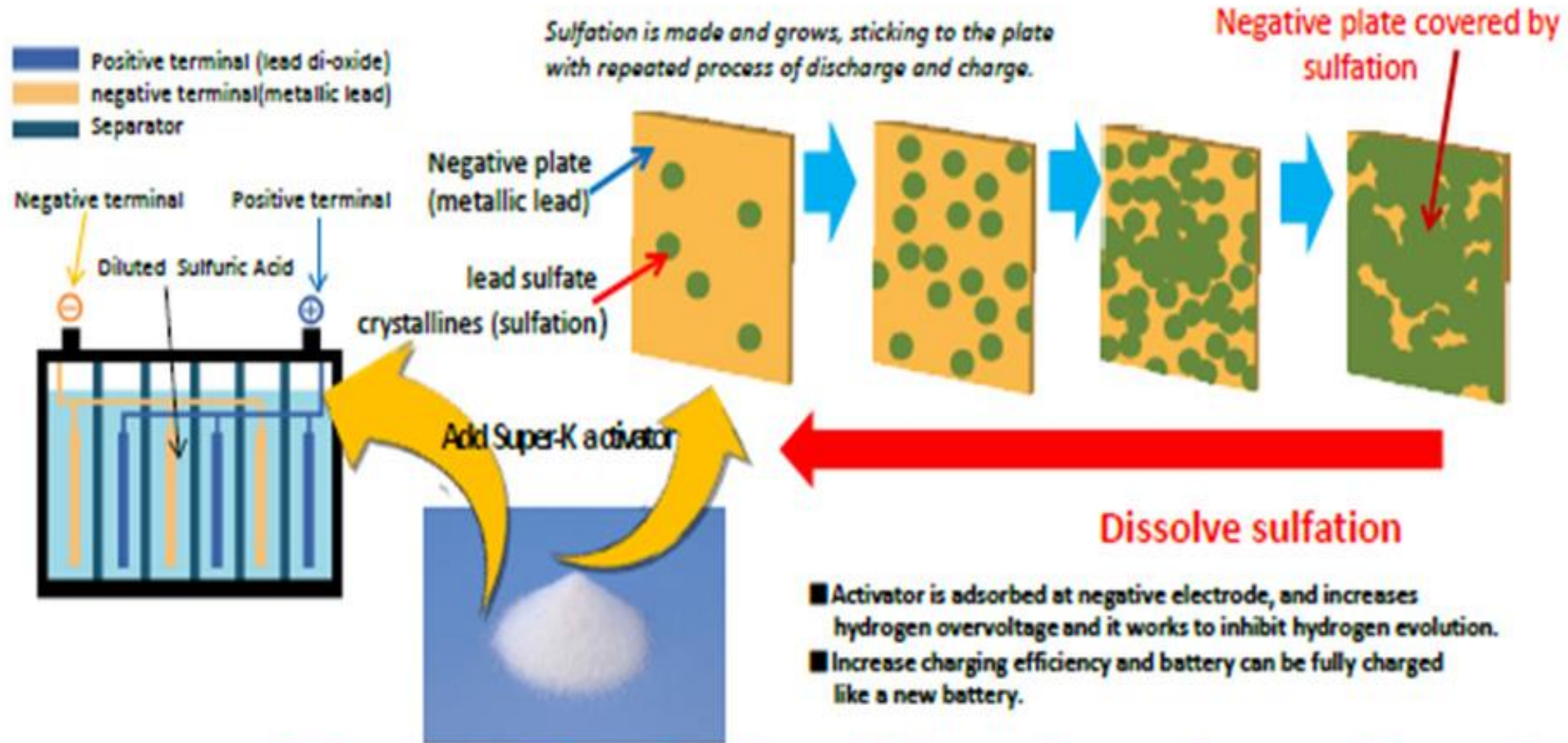for vehicle batteries

A type Super-K activator
for deep cycle batteries

- With once-a-year or once-every other-year addition of Super-K activator, you can extend life of lead-acid batteries by 3 to 5 more years, when used in batteries deteriorated by sulfation.
- Majority of old abandoned batteries can be regenerated for years of use by Super-K activator and our special regeneration charging method.

How Super - K Works?

(1) Lead-acid Battery deteriorated by Sulfation

Positive terminal (lead di-oxide)
negative terminal(metallic lead)
Separator

Negative terminal   Positive terminal

Diluted Sulfuric Acid

Negative plate (metallic lead)

lead sulfate crystallines (sulfation)

Sulfation is made and grows, sticking to the plate with repeated process of discharge and charge.

Negative plate covered by sulfation

Add Super-K activator

Dissolve sulfation

■ Activator is adsorbed at negative electrode, and increases hydrogen overvoltage and it works to inhibit hydrogen evolution.
■ Increase charging efficiency and battery can be fully charged like a new battery.

(2) Super-K activator dissolves Sulfation and Battery becomes like New !

Activities Done at Battery Charging Center

➤ **Demonstrated how to do regeneration using Super K additive**

➤ Confirmed battery conditions before and after the regeneration work (such as specific gravity of each cell and voltages of batteries, and voltages after discharge tests, etc.)

➤ **Gave lecture for battery regeneration at charging center for electric rickshaw**

Training Session of Battery Regeneration

Problem #4:
Landslides occur during heavy monsoon season. It destroys villages and kills people living in the mountains.

Solution:
Install early landslide warning system to inform people in advance.

Landslide Early Warning System

Team Meeting – Japanese and Nepali Experts

http://www.technosales.com.np

Landslide Early Warning System in Keraunja, Nepal

Challenges Incurred

1. Earth quake made some villages inaccessible
2. Slow rebuilding work of the government
3. Many school buildings and clinics not ready
4. Difficult to get permission for the VHF and TVWS bands from the government

Outcomes of Pilot Project - 1

1. It is the first time Nepal government granted permission to use VHF and TVWS spectrum for broadband Internet.
2. It will open a new window of opportunities for the wireless internet service providers in the rural areas of Nepal.
3. A hybrid community network could be built using a combination of Wi-Fi, VHF and TVWS technology to bring broadband internet in remote mountain villages.
4. Became able to test the performance of broadbandVHF and TVWS technology developed by Hitachi Kokusai Electric Inc. and Carlson Wireless Technologies.

Outcomes of Pilot Project - 2

4. Introduced successfully battery regeneration system in Nepal developed by Japan Battery Regeneration Company. A larger scale plan in being made.

5. Became able to install and successfully test new technology of trekking tracking system developed by Nomura Engineering Company Japan.

6. Became able to install the landslide early warning system in Keraunja village of Gorakha district.

7. Nepal Wireless became able to bring broadband Internet in 15 villages of Gorakha, Sindhupalchok and Dhading district.

Recommendations 1

1. The VHF equipment produced by Hitachi Kokusai Electric Inc, Japan is a very good option for long range point to point broadband connectivity in non-line of sight environment.

2. The TVWS equipment of Carlson Wireless Technology works better than Wi-Fi in terms of coverage and connectivity in difficult terrains.

3. 2nd Generation Carlson devices were not as good as it has been told. Need to wait and see how good their 3rd Generation device works