



Assessment Trip – WiFi4Crea

Cocobolo, Panama

Engineers Without Borders – USA

Sun Professionals

San Francisco Professionals



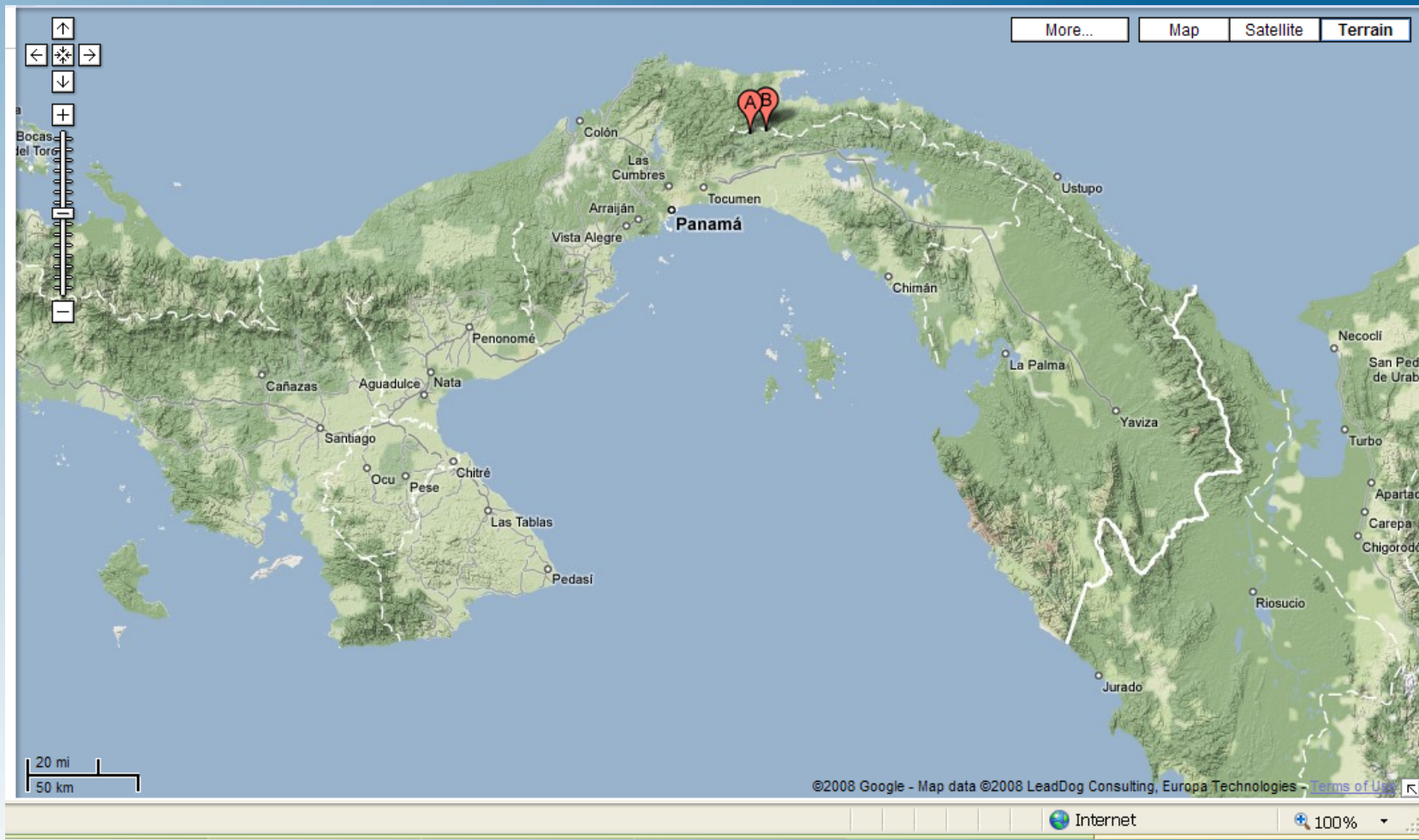
Introduction

- Wifi4Crea is a joint project between the San Francisco Professionals / Sun Professionals Chapter of Engineers Without Borders and CREA Panama
- The purpose of the project is to provide an inexpensive and fast internet connection to the Cocobolo Nature Preserve in Panama
- The internet connection will serve to provide CREA with the ability to improve remote monitoring of the rainforest and give training and internet information retrieval capabilities to 1000 local villagers



Location

- Cocobolo, Panama





Local Area Description

- Rainforest suffers from slash-and-burn subsistence farming
- Local villagers live on average of \$2USD/day
- Replacing slow and expensive satellite internet connection with Wifi will enable:
 - Students the ability to study and monitor rainforest conditions
 - Villagers to learn about sustainable farming techniques



The Rainforest



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Cocobolo - Big Hut



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Setting Up a Communications Test



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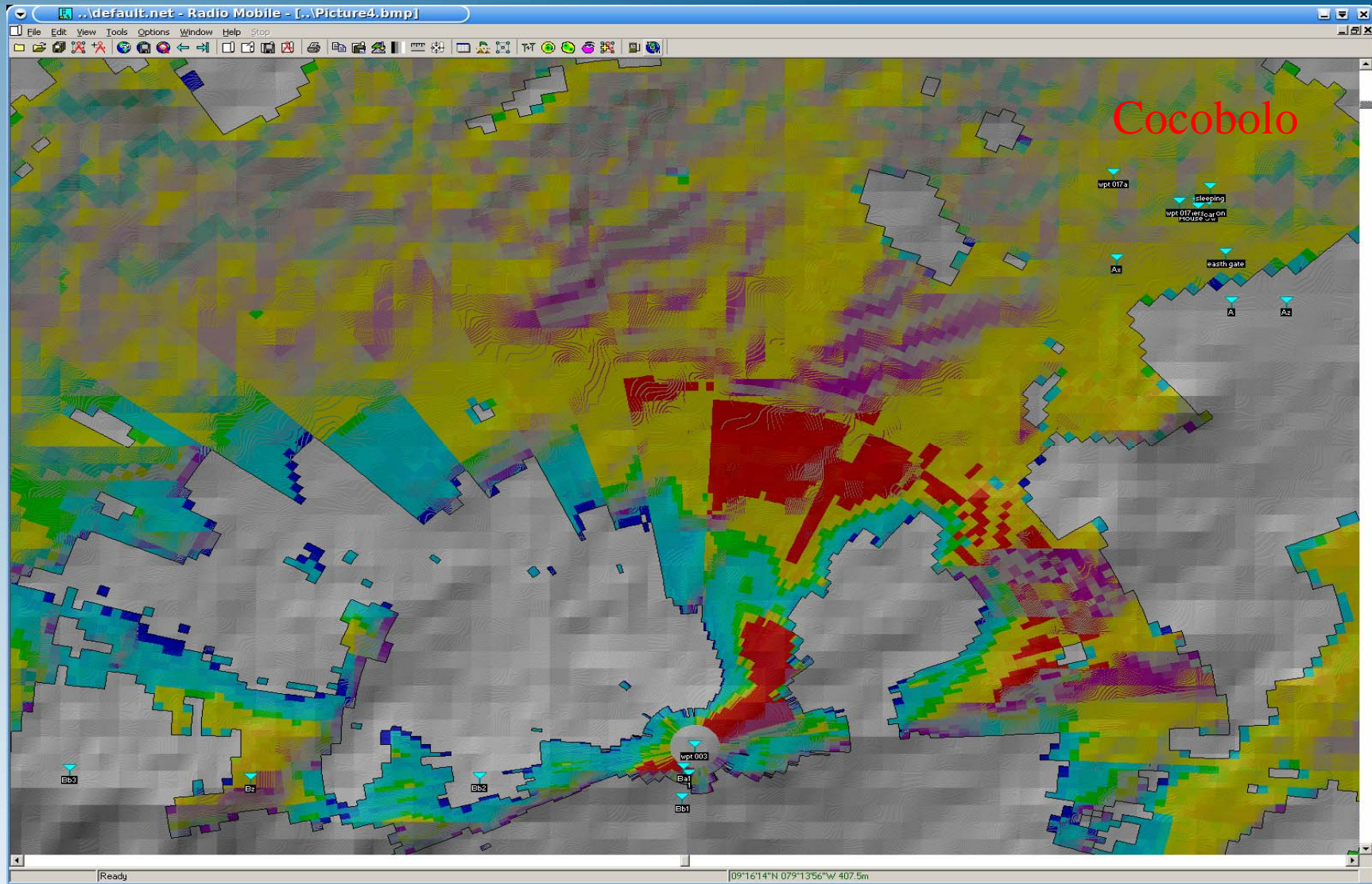
Terrain and Conditions

- Hillside where connection is required can be wet, foggy, and rainy
- Assessment trip evaluated optimal placement sites for communication towers





RadioMobile Coverage plot - Hill

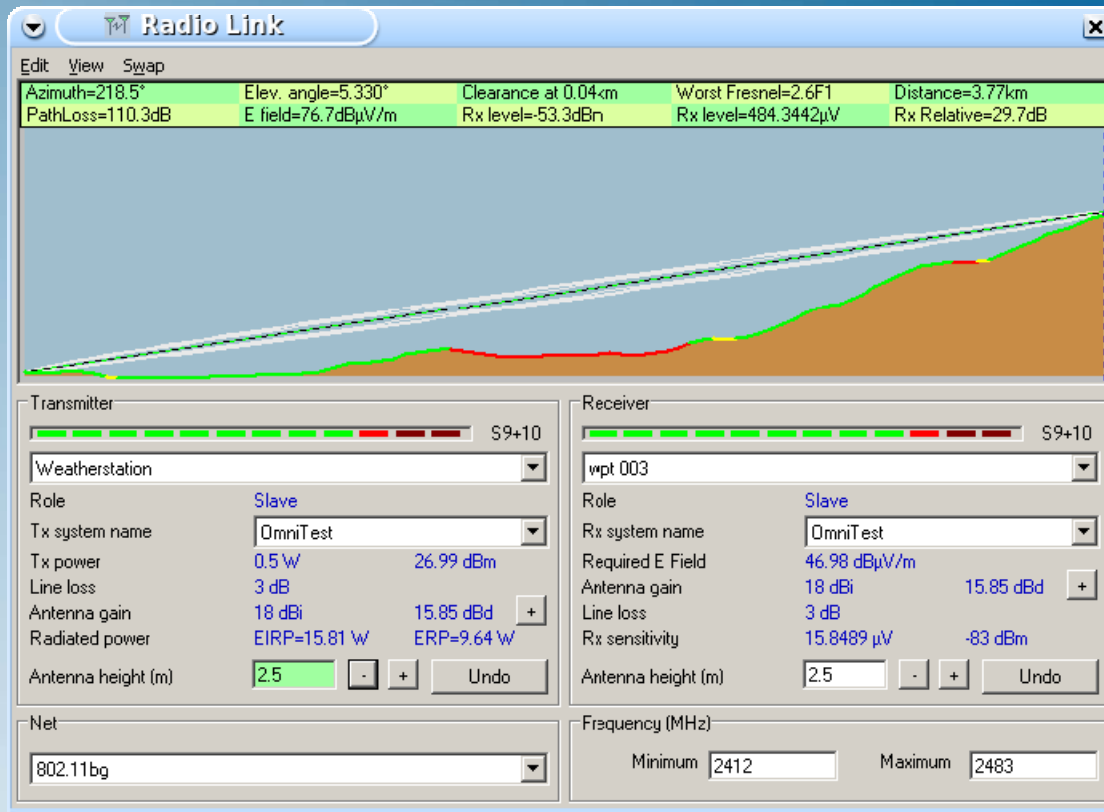


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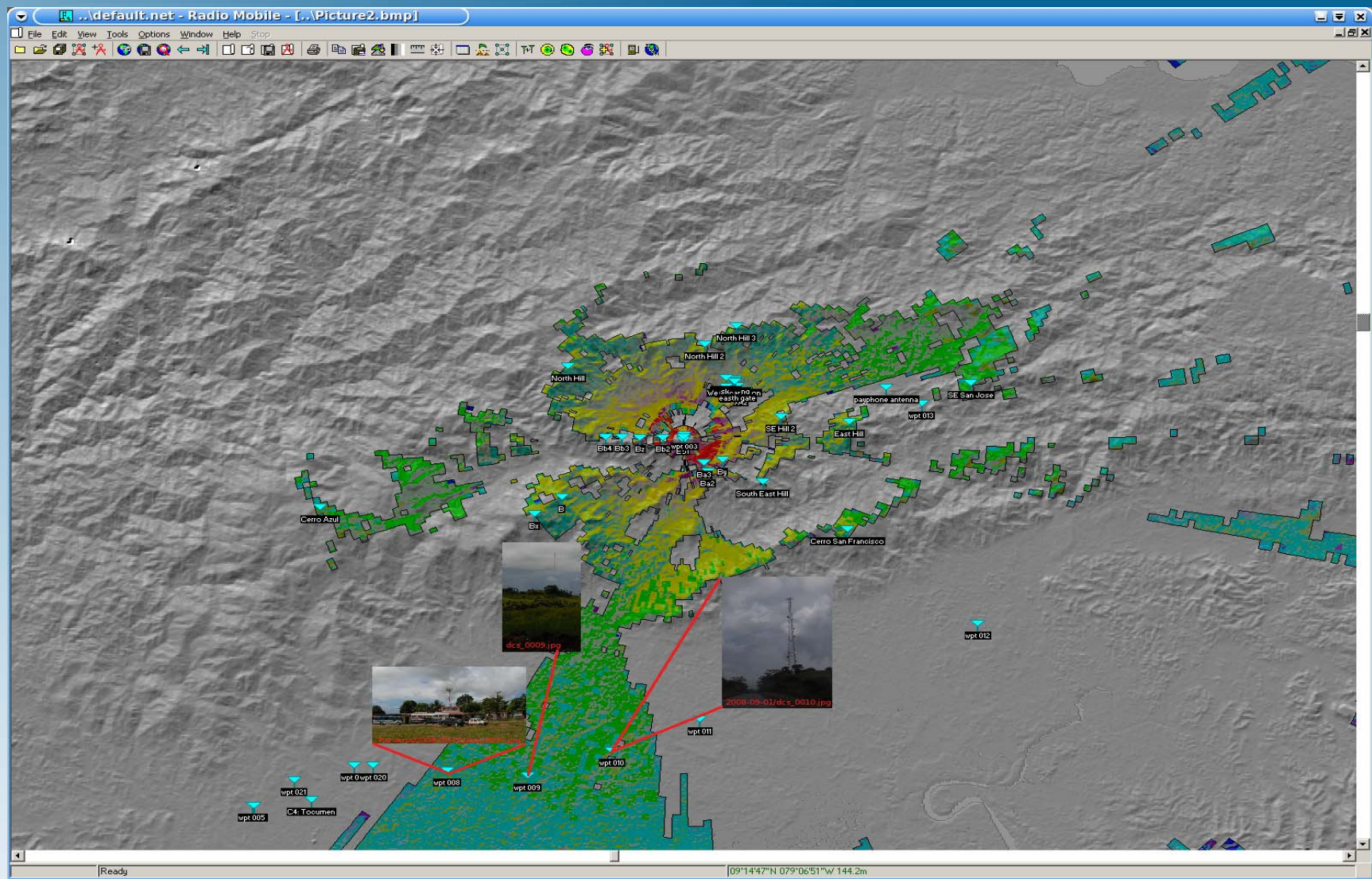
Hill → Weatherstation



- Very strong signal for this short distance



To the Outside



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Hill → Outside

Radio Link

Azimuth=211.2°	Elev. angle=-1.518°	Clearance at 8.03km	Worst Fresnel=1.7F1	Distance=21.37km
PathLoss=125.2dB	E field=61.8dB μ V/m	Rx level=-68.2dBm	Rx level=86.9189 μ V	Rx Relative=14.8dB

Transmitter
Role: Slave
Tx system name: OmniTest
Tx power: 0.5 W (26.99 dBm)
Line loss: 3 dB
Antenna gain: 18 dBi (15.85 dBd)
Radiated power: EIRP=15.81 W (ERP=9.64 W)
Antenna height (m): 2.5

Receiver
Role: Slave
Rx system name: OmniTest
Required E Field: 46.98 dB μ V/m
Antenna gain: 18 dBi (15.85 dBd)
Line loss: 3 dB
Rx sensitivity: 15.8489 μ V (-83 dBm)
Antenna height (m): 8

Net
802.11bg

Frequency (MHz)
Minimum: 2412, Maximum: 2483

Radio Link

Azimuth=201.5°	Elev. angle=-1.663°	Clearance at 18.28km	Worst Fresnel=2.3F1	Distance=19.93km
PathLoss=124.4dB	E field=62.5dB μ V/m	Rx level=-67.4dBm	Rx level=95.0875 μ V	Rx Relative=15.6dB

Transmitter
Role: Slave
Tx system name: OmniTest
Tx power: 0.5 W (26.99 dBm)
Line loss: 3 dB
Antenna gain: 18 dBi (15.85 dBd)
Radiated power: EIRP=15.81 W (ERP=9.64 W)
Antenna height (m): 2.5

Receiver
Role: Slave
Rx system name: OmniTest
Required E Field: 46.98 dB μ V/m
Antenna gain: 18 dBi (15.85 dBd)
Line loss: 3 dB
Rx sensitivity: 15.8489 μ V (-83 dBm)
Antenna height (m): 6.6

Net
802.11bg

Frequency (MHz)
Minimum: 2412, Maximum: 2483

Radio Link

Azimuth=191.1°	Elev. angle=-1.741°	Clearance at 17.39km	Worst Fresnel=2.7F1	Distance=17.50km
PathLoss=123.5dB	E field=63.5dB μ V/m	Rx level=-66.5dBm	Rx level=105.9895 μ V	Rx Relative=16.5dB

Transmitter
Role: Slave
Tx system name: OmniTest
Tx power: 0.5 W (26.99 dBm)
Line loss: 3 dB
Antenna gain: 18 dBi (15.85 dBd)
Radiated power: EIRP=15.81 W (ERP=9.64 W)
Antenna height (m): 2.5

Receiver
Role: Slave
Rx system name: OmniTest
Required E Field: 46.98 dB μ V/m
Antenna gain: 18 dBi (15.85 dBd)
Line loss: 3 dB
Rx sensitivity: 15.8489 μ V (-83 dBm)
Antenna height (m): 2.5

Net
802.11bg

Frequency (MHz)
Minimum: 2412, Maximum: 2483

- Around those three points the signal is good.



Proposed Equipment - Outside

- Currently exact location unknown
- DSL/Cable Modem from ISP
- Ubiquiti Powerstation2 (PS2-18V)
- Pole/tower to clear the surrounding structures



Proposed Equipment - Hill

- Clearance from the landowner needed
- 2 x PS2-18V
- Poles 2.5 m (+.5 in the ground) to clear grass/cows/ Cable fastent
- Solar Panel $\geq 125W$
- AGM Battery 12V, $\geq 75Ah$
- Charge Controller
- "Control Computer/Switch"
- Fences, Cat 5, Enclosures ...



Control Computer

- Propose WAP – Asus WL500gP V2
- OpenWRT
- 2xUSB (one to monitor charge controller via USB->Serial)
- Remote monitoring
- Possibly weatherstation/Sunspot basestation
- Switch to help with the length limit



Proposed Equipment - Cocobolo

- PS2-18V
- Pole to clear structures
- Asus WL500gP V2 as local distribution point



Project Teams Needed

- Hardware acquisition
- Solar panels to power communications equipment
- Towers for holding equipment in field
- Overall project management



Equipment Costs - Estimates

- 4x Ubiquiti PS2-18V \$160/each \$ 640
- Solar Panel Kyocera KC130TM (or sim.) \$ 629
- AGM Battery MK 8A27AGM 92Ah(or sim)\$ 215
- Morningstar Sunsaver MPPT Controller \$ 245
- 2x Asus WL-500gP V2 \$95/each \$ 190
- USB-Serial Converter \$ 20
- Poles/cables/fences \$ 200
- Panama - Bay Area Total \$ 2140