Puerto Rico Student Test Bed
IP-3

By
Manuel A. Vega-Cartagena
Carlos A. Rodríguez-Rivera
CASA SLC Members
UPRM Graduate Students

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Overview

• Magnetron Radar
  – Radar Specifications
  – Calibration Channel
  – Corner Reflector
  – Logarithmic Detector (Video)
Student Test Bed

• Objective
  – To establish a QPE sensing network starting in the western end of the island taking into consideration coverage gaps from NEXRAD.

• Radar Sites
  – Three sites were selected based on geographical data and sociological impact. These are located in Mayagüez, Aguadilla.
Student Test Bed

SLT Area
Flooding Areas in Western Puerto Rico

SLT Area
Weighted Total Population

Legend
- pr_northwest_100FEMA polygons
- Counties
- pr_northwest_100FEMA polygons
- block groups SLT

Legend
- selected events layer
- SLT Block Demographics include computed area/POP
- 0-4.92
- 5-9.42
- 10-14.92
- 15-19.92
- 20-24.92
- 25-29.92
- 30-34.92
- 35-39.92
- 40-44.92
- 45-49.92
- 50-54.92
- 55-59.92
- 60-64.92
- 65-69.92
- 70-74.92
- 75-79.92
- 80-84.92
- 85-89.92
- 90-94.92
- 95-99.92
- 100+
RADAR

The COMET Program
Radar Specifications

- Raytheon Marine X-Band Radar
- Single Polarization
  - Magnetron
    - $F = 9.41 \text{ GHz}$
    - $P_{\text{peak}} = 25 \text{ kW}$
    - $\text{Duty Cycle}_{\text{max}} = 0.001$
Radar Specifications

• Modifications
  – Antenna
    • 1.22m Parabolic Dish
    • G = 38 dB
    • 2.0° HPBeamwidth
  – Spinner
    • Originally 25 RPM
    • Lowered to 3 RPM
Radar Specifications

• Modifications
  – Data System
    • Linux based Mini-ITX embedded system
    • 12 Bit ADC for sampling video signal
    • 802.11b data transport to data archive server
  – Control
    • FPGA on PCI bus for timing signals and antenna position encoder data
Radar Specifications

• Location
  – Roof of electrical engineering building at UPRM
  – Waveguides already installed
Radar Specifications

Raytheon X-Band Radar
Modified Front End Diagram

Magnetron

9.41 GHz
P = 25 kW = 74 dBm

Raytheon HV
Modulator
Board

Isolator

IL = 0.4 dB

Load

Power Sampler

50 dB

Attenuator

35 dB

Circulator

IL = 0.5 dB
Isolation = 25 dB

Limiter

Pmax = 26 dBm
IL = 2 dB

HP Beamwidth = 2.0°
Gain = 38.0 dBi

PIN Switch (Reflective)
IL = 0.85 dB
Isolation ≥ 67 dB

Noise Source
ENR = 15.5 dB

Power Combiner

Calibration Loop

LNA

Gain = 7.0 dB
PtdB = -8 dBm
F = 3.5 dB

VCO

9.470 GHz

IR Mixer

IF 60 MHz

To Data System

Receiver Noise Figure = 8.00 dB
Receiver Dynamic Range = 91.74 dB
Radar Specifications
Corner Reflector

Received Power vs Range

Received Power (dBm)

Range (m)

X: 2004
Y: -15
Corner Reflector
Corner Reflector
Latest Achievements
Latest Achievements

Nubes de Lluvia

Received Power (dBm)

Range (m)
Latest Achievements

is not to scale

4' antenna with Radome

Spinner

Transceiver

Embedded PC

Cables

Access Point

S-120A

casa
Welcome to STB Portal

Puerto Rico Student Test Bed

Students to design and build weather-sensing radar system

The Student Test Bed, an innovative CASA education project, is being developed and implemented at the western area of Puerto Rico. The STB project is led and managed entirely by students and serves as a fundamental component of their education. The multi-disciplinary, multi-level, multi-campus team is composed of students from University of Massachusetts, University of Puerto Rico, University of Oklahoma and Colorado State University.

The primary mission of the Puerto Rico STB is to validate the CASA approach in variable terrain. The test bed will follow parallel research paths using off-the-shelf hardware to construct the network while developing a new type of low power radar. The test bed will focus on constructing a network of radars to provide detailed QPE information to the people of Puerto Rico while educating students and advancing radar technology.

Project Goals

- Establishing a QPE sensing network starting at the western end of the island
- Filling in NEXRAD coverage gaps
- Improve precipitation estimates for western Puerto Rico
- Developing a CASA strategy for tropical QPE
- Exploring the feasibility of an "off the grid" radar
- Exploring the capabilities of short range, high beamwidth, and limited node computation radar network.
Latest Achievements
Questions?