

The  
**WAVERIDER**



**By Erik Brom, Bill Roberts and  
Jim Biesterveld**

**The WaveRider was originally  
owned by EGS, Inc.**

**The system is now owned by  
Bill Roberts,  
Stray Voltage Testing, LLC.**

**Bill supports the Northeast and  
Midwest.  
[www.strayvoltage.com](http://www.strayvoltage.com)**

**Erik Brom,  
Brom Microsystems Engineering,  
Inc, manufactures the WaveRider  
and develops the software.**

**Erik is in Winona, MN and  
originally worked with EGS. Inc.**

**Jim Biesterveld  
does stray voltage investigations  
for  
Dunn Energy Cooperative  
using the WaveRider**

**Erik is going to give you the  
technical points used by the  
WaveRider  
&  
Some of the new advancements  
coming for WaveRider**

**Bill and I  
will talk about how the  
WaveRider is connected to  
get the data we require.**

## Erik will now present the technical data

- Overview of the system
- RMS vs Peak
- Future

## The WaveRider System



## WaveRider Specifications

- The WaveRider has 8 differential input channels.
- 5 channels are 5 volts peak
- 1 channel is 400 volts peak
- 1 channel is 25 volts peak
- 1 channel is 100 volts peak

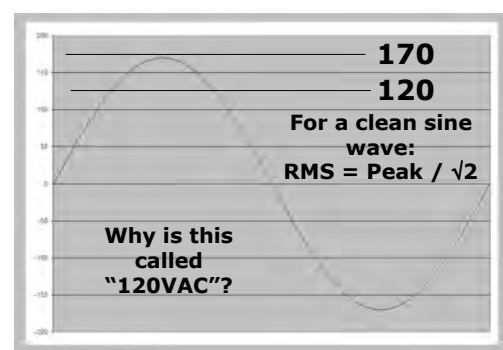
## Input Filtering and Sampling

- The input is designed to pick up AC signals up to about 2500 Hz (2.5 KHz).
- The peak value of the signal over each 1/60<sup>th</sup> of a second (60Hz) is measured.
- If the value meets certain criteria, it is recorded.
- Each recorded value is called a "peak".

## Peak Recording Criteria

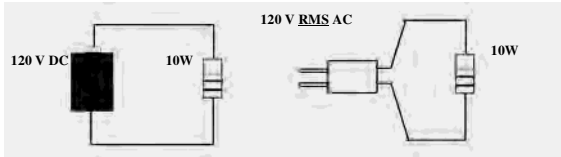
- The value must be above a threshold.
- The value must differ from the last recorded peak by more than a specified deviation value.
- If the value meets these criteria, it is recorded in the data file.

## Peak vs RMS and what the Waverider shows you



RMS = "Root Mean Square" or Square Root of the Mean (average) of each sample squared.

An AC signal of a certain RMS voltage will produce the same amount of heat in a resistor as a DC source of the same voltage:



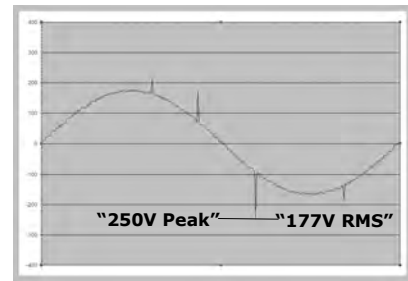
## RMS vs True RMS

- True RMS means that the value displayed is correct regardless of the Waveform.
- The correct value will be displayed for a clean or noisy sine wave, or any other waveform.
- Some meters, including the WaveRider, will display the exactly correct value only for a clean sine wave.

## RMS vs True RMS

- We display RMS on the WaveRider because we can relate to it better.
- The WaveRider was not designed to read True RMS, and is not capable of it.
- Opinions vary on whether True RMS is useful in stray voltage detection.
- It may be possible to add software to the WaveRider to display pseudo RMS.

## A Noisy Signal



## Future of the WaveRider

- The sampling technique and scale have been described as "the best in the business" by many users. We will continue to support this.
- The present system, which is the second generation, has been in production since 1992.

## Future of the WaveRider

- The present generation product is still available from Stray Voltage Testing, but the parts are getting hard to get, and expensive.
- We have enough parts to continue servicing them for many years.

### **Future of the WaveRider**

- We are gathering ideas for the third generation product.
- No specific schedule has been set for its introduction.
- With today's powerful personal computers, additional data analysis is possible, even with the present product.
- A stand-alone unit is a possibility.
- Use of the Internet is a possibility.

### **Future of the WaveRider**

At the end of the presentation, or afterwards, please give us your ideas.

Also, we are developing a related product that is not ready for introduction yet. It is related but will not compete with the WaveRider.

### **How Jim uses the WaveRider**

- Channel A reads cow contact voltage
- Channel B reads voltage in the trailer
- Channel C reads voltage between the secondary neutral in the barn and the reference ground rod
- Channel D reads cow contact voltage
- Channel E reads cow contact voltage

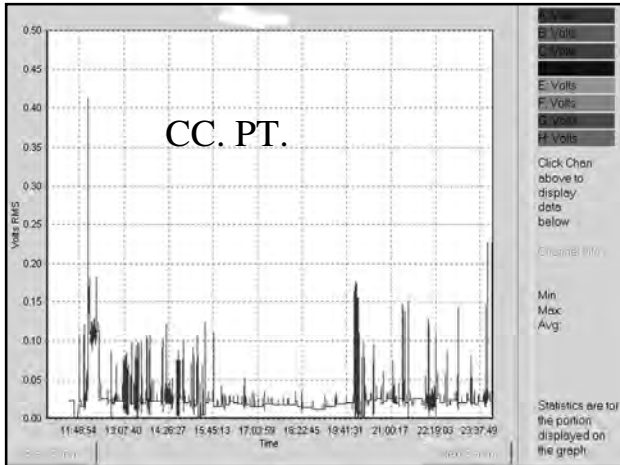
### **How Jim uses the WaveRider**

- Channel F reads voltage between the primary neutral and the reference ground rod
- Channel G reads the same as channel F (different scale)
- Channel H reads voltage between primary neutral and the secondary neutral in the barn.



### **Channel A**

**COW CONTACT POINT  
POST # ONE**



**Channel B**

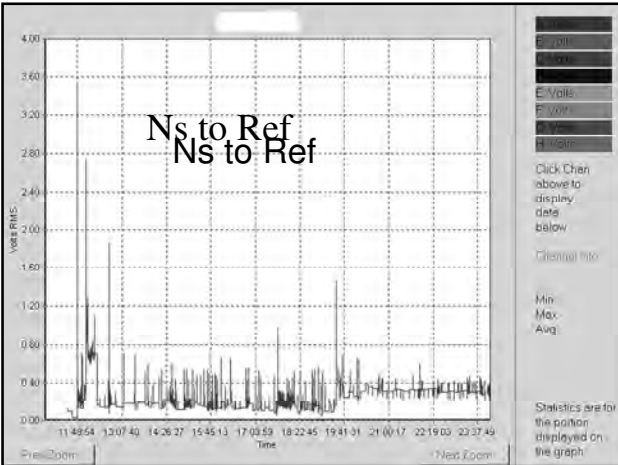
**120 VOLT SURVEY CONDUCTED  
AT THE COMPUTER LOCATION  
IN THE TEST TRAILER**



We pull the plug for the test circuit so it will give a zero mark at the start and stop of the load box test.

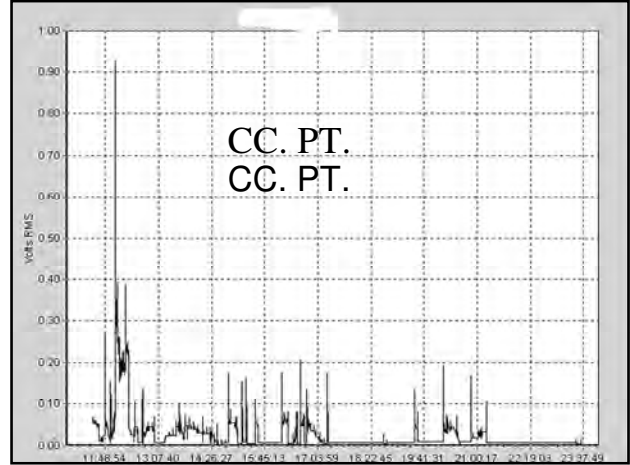
**Channel C**

READING BETWEEN THE  
SECONDARY NEUTRAL  
IN THE BARN  
AND THE REFERENCE  
GROUND ROD



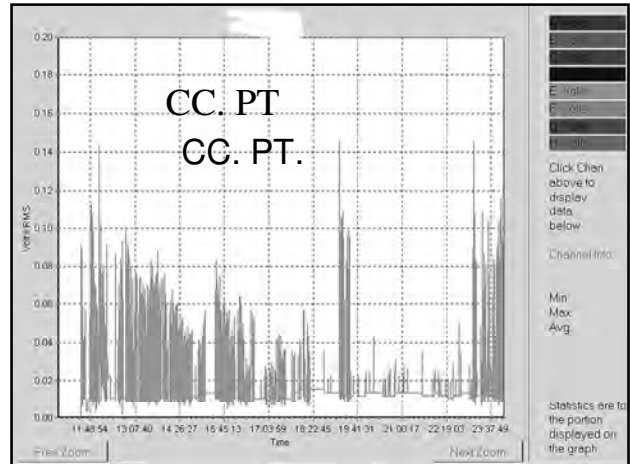
### Channel D

COW CONTACT POINT  
POST # TWO



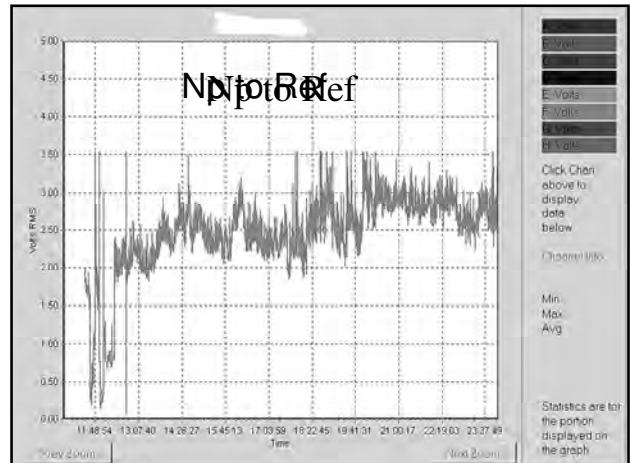
### Channel E

COW CONTACT POINT  
POST # THREE



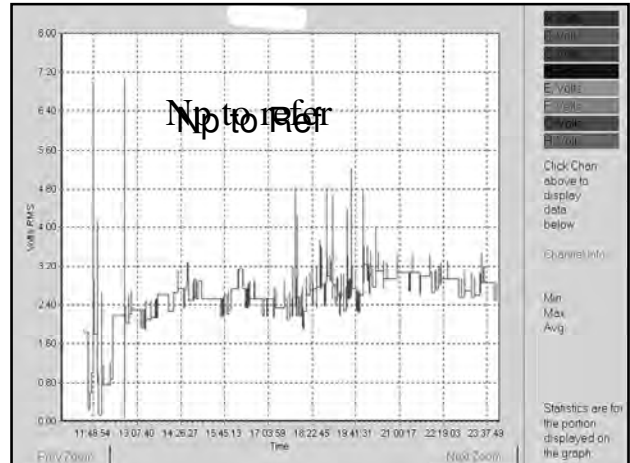
### Channel F

READING BETWEEN THE  
PRIMARY NEUTRAL  
AND THE REFERENCE  
GROUND ROD



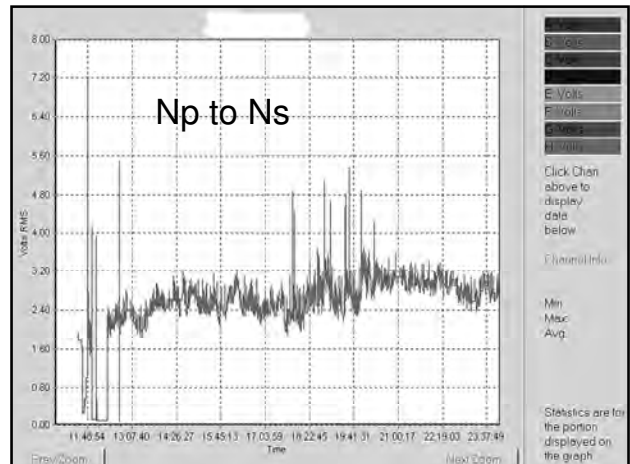
## Channel G

SAME AS CHANNEL F  
HIGHER SCALE



## Channel H

READING BETWEEN  
THE PRIMARY NEUTRAL  
AND THE  
SECONDARY NEUTRAL  
IN THE BARN



We set posts for the cow contact points unless the ceiling is too high, then we use a weighted brass plate.

See example



## QUESTIONS?

## HISTORY

- Started testing for Stray Voltage in 1985.
- Have tested over 2400 farms.
- Have gone through 6 pick-ups, all over 250,000 miles.
- Purchased the WaveRider ownership from EGS, Inc., in 1997.
- Changed from a DOS program to a Windows program.

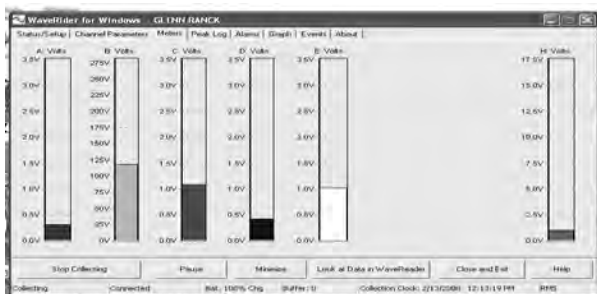
## NEW YORK STATE

- 60% to 70% of farms are serviced by a Delta system.
- 30% to 40% of farms are serviced by a grounded Wye system.

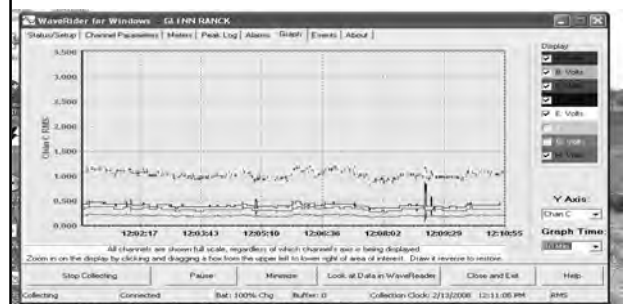
## WAVERIDER LOOK

- METERS: Bar Graph
- GRAPH: Running Graph
- DATA LOG: Time - Voltage - Location

## Meters



## Graph





## Data

Time	Channel	Voltage RMS
12:14:30.300	Chan: B	0.4855
12:14:30.350	Chan: C	1.3128
12:14:30.360	Chan: A	0.3580
12:14:30.400	Chan: H	3.1013
12:14:30.410	Chan: A	0.3082
12:14:30.410	Chan: C	0.2870
12:14:30.410	Chan: D	0.3951
12:14:30.410	Chan: E	0.2808
12:14:30.410	Chan: H	0.3850
12:14:30.480	Chan: H	0.3997
12:14:31.000	Chan: C	1.0030
12:14:31.000	Chan: D	0.4222
12:14:31.010	Chan: A	0.2484
12:14:31.010	Chan: E	1.0516
12:14:31.010	Chan: H	1.042
12:14:31.010	Chan: C	1.0913
12:14:31.200	Chan: H	3.101
12:14:32.530	Chan: C	1.3318
12:14:32.560	Chan: E	1.2207
12:14:32.670	Chan: C	1.0261
12:14:34.310	Chan: H	3.062

## TESTING WITH THE WAVERIDER

- Channel "A" 3.50 Volts RMS
- Channel "B" 283.0 Volts RMS
- Channel "C" 3.50 Volts RMS
- Channel "D" 3.50 Volts RMS
- Channel "E" 3.50 Volts RMS
- Channel "F" 3.50 Volts RMS
- Channel "G" 70.7 Volts RMS
- Channel "H" 17.7 Volts RMS

## TESTING LOCATIONS

- Stall to Cow Floor
- Stall to Man Floor
- Holding Area Floor to Parlor Floor
- Water to Floor
- Feeder to Floor
- Pipeline to Floor
- Main Secondary Neutral to Remote Ground Rod
- Sub-panel Neutral to Remote Ground Rod
- Primary Neutral to Remote Ground Rod

## TESTING PROCEDURE

- Set up by running wires to the locations to be tested.
- Everything is turned off at the farm.
- Main disconnect is turned off if voltage is still present.
- Do a WaveRider signature test.
- Display to farmer what transpired during the WaveRider signature test.
- Explain what needs to be done to reduce the stray voltage found.

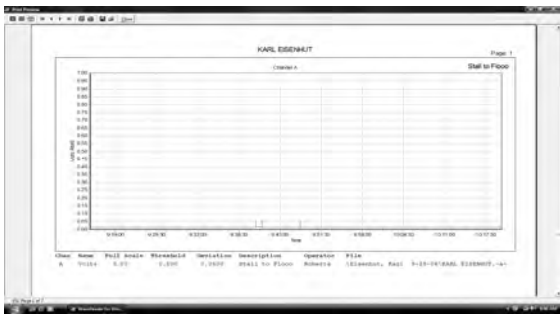
## REPORT

- After returning to the office, a copy of the data collected is printed and sent to the farmer:
- Complete Report.
- WaveRider signature test in 10 minute intervals.
- Cover letter stating causes of the stray voltage and how to correct it.

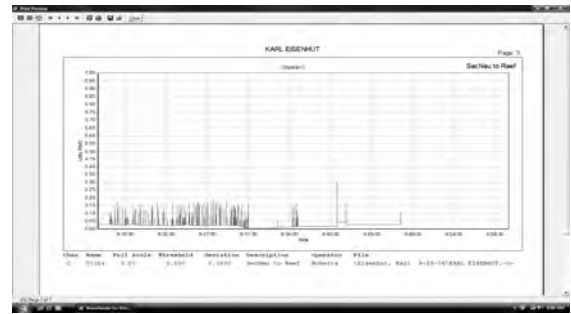
## EXPERIENCE

- Need to check many locations at the same time.
- Five to seven is the norm.
- In the farm's electrical service – stray voltage is not always the same on the main and a sub-panel.

## STRAY VOLTAGE STALL/FLOOR



## STRAY VOLTAGE MAIN SEC/NEU TO EARTH



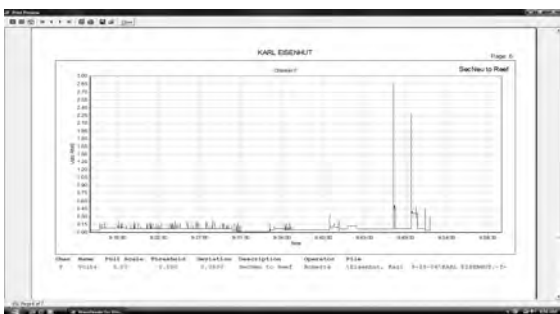
## STRAY VOLTAGE PIPELINE TO FLOOR



## STRAY VOLTAGE SUB-PANEL #1 TO EARTH



## STRAY VOLTAGE SUB-PANEL #2 TO EARTH



## RESULTS

- RESULTS IN FOUR MONTHS AFTER CORRECTION WAS MADE!
- REDUCED SCC BY 50000
- PRODUCTION WENT UP 15#'S PER COW
- EVEN WITH THE INCREASE IN PRODUCTION HE CUT 15 TO 20 MINUTES OFF EACH MILKING

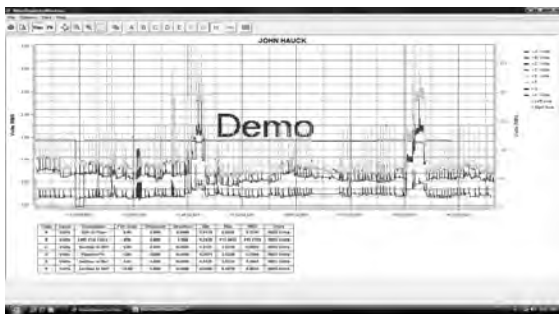
## Future

- Long term plans as described.
- Short term: updating the WaveReader software.

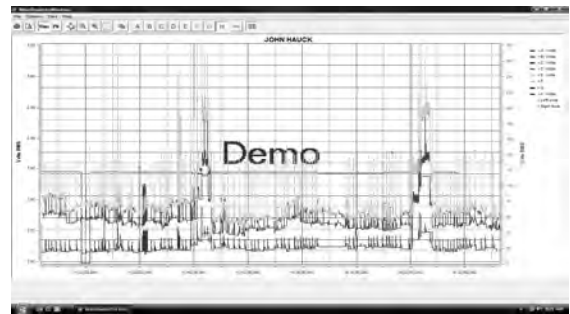
## New Features in WaveReader 3

- MUCH faster graphing.
- Multiple Y-Axis.
- Animal Current scale calculator.
- More printing options.

## NEW WAVEREADER WITH DATA SHOWN



## NEW WAVEREADER WITHOUT DATA SHOWN



## SERVICE

- All parts are available to service your WaveRider.
- Calibration.
- New WaveRiders are available.
- Windows software is available.
- The WaveRider is alive and well!

## INFORMATION

- [www.strayvoltagegtesting.com](http://www.strayvoltagegtesting.com)
- CURRENT WAVE RIDER PROGRAM 2.1
- CURRENT WAVE READER PROGRAM 2.1
- CELL PHONE NUMBER 315-794-5324

**THANK YOU!**

**QUESTIONS?**