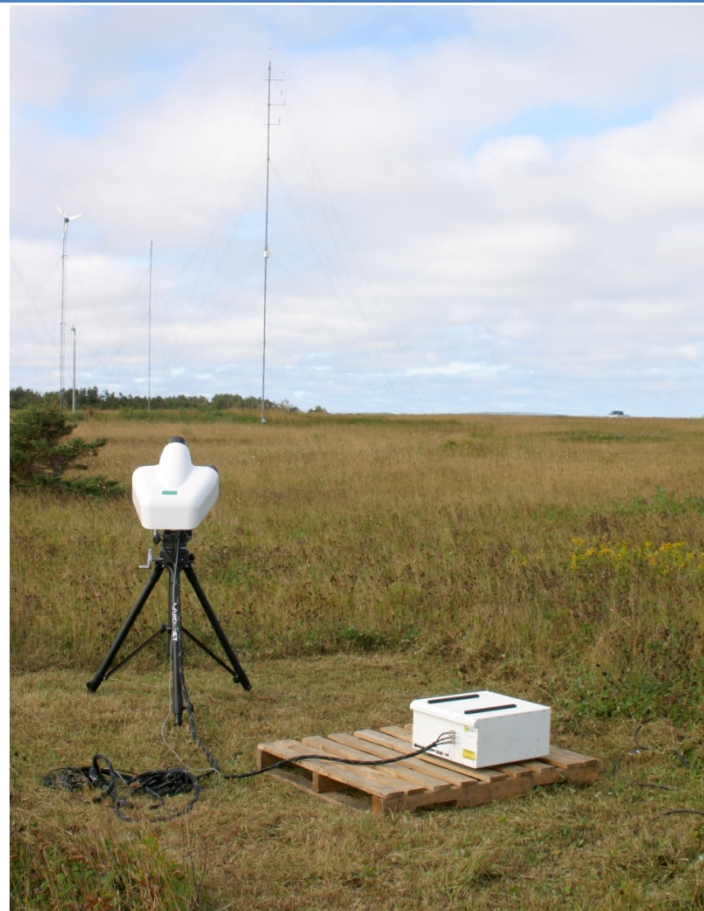


CATCH THE WIND VINDICATOR™ LASER WIND SENSOR GROUND TEST SUMMARY



Every effort has been made to ensure that the results contained within this document accurately represent the performance of the product being tested. This summary, as well as the testing apparatus and procedure used have been designed to use the guidelines set by IEC standards, unless otherwise stated.

Internal Review:

X

Paul Dockrill
Director of Technology

X

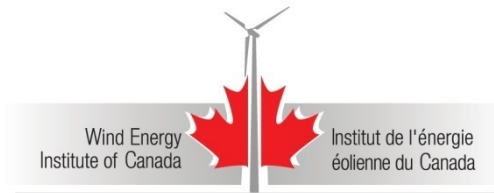
Date

X

Gerald Giroux
Measurement Engineer

X

Date



Wind Energy Institute of Canada

Vindicator™ Laser Wind Sensor Static Performance Test Summary

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Table of Contents

1	LIST OF FIGURES	5
2	DISCLAIMER	6
3	BACKGROUND	7
4	TEST OBJECTIVE	8
5	TEST SITE	9
5.1	PHOTOGRAPHS OF SITE.....	10
5.2	SITE LAYOUT	11
6	TEST EQUIPMENT	12
6.1	SENSORS AND DATA ACQUISITION SYSTEM.....	12
6.2	DESCRIPTION OF CUP ANEMOMETERS	13
6.3	DIAGRAM OF METEOROLOGICAL MAST	14
7	MEASUREMENT PROCEDURE	15
7.1	MEASUREMENT PERIOD	15
7.2	DATA REJECTION.....	15
8	MEASURED DATA	16
9	TEST SUMMARY	20
	APPENDIX A: WEATHER PARAMETERS AT NORTH CAPE	21

1 LIST OF FIGURES

FIGURE 3 - 1 – PICTURE OF THE VINDICATOR™ LASER WIND SENSOR SYSTEM	7
FIGURE 4 - 1 – DRAWING SHOWING DISTANCE FROM MET TOWER.....	8
FIGURE 5 - 1 – PICTURES OF SITE TAKEN FROM VINDICATOR™ LASER WIND SENSOR POSITION	10
FIGURE 5 - 2 - WEICAN SITE TOPOGRAPHY.....	11

2 DISCLAIMER

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3 BACKGROUND

The primary purpose of this test is to provide an independent assessment of the performance, reliability, and safety of the Vindicator™ Laser Wind Sensor system (see Figure 3-1) which is designed by using a novel interpretation of the LIDAR technique. The system's light weight design and small foot print make it ideal for installations on turbine nacelles, where it will be used to predict the wind speed and direction. The Vindicator™ Laser Wind Sensor system is designed and manufactured by Catch the Wind Inc.

The Vindicator™ Laser Wind Sensor is a LIDAR system that remotely measures the three-dimensional wind velocity. The tested prototype was configured to measure at a fixed distance of 80 meters from the optics and reports the horizontal wind speed and direction. The Vindicator™ Laser Wind Sensor measures wind velocity in an air volume, while cup anemometers measure horizontal wind speed at a point. The goal of this test is to demonstrate sufficient correlation between the Vindicator™ Laser Wind Sensor and cup anemometers and wind vane measurements before mounting it on a 65 kW WindMatic wind turbine, located at WEICan.

Catch the Wind Inc. (CTW) is a high technology company headquartered in Manassas, Virginia. The company was founded in 2008 to develop and manufacture laser based wind sensor systems with a primary focus on developing technology to serve the wind power generation industry. CTW serves the commercial market sector for laser based wind sensor systems, recognized as the “gold standard” in wind measurement. The company is focused on becoming a major element in the move to provide clean renewable energy.



Figure 3 - 1 – Picture of the Vindicator™ Laser Wind Sensor system

4 TEST OBJECTIVE

The Vindicator™ Laser Wind Sensor was positioned such that it was measuring the wind speed and direction at the location of a MET mast which was designed based on International Electrotechnical Commission (IEC) standards as shown in the figure below. This equipment was installed at WEICan's test site located at North Cape, Prince Edward Island, Canada.

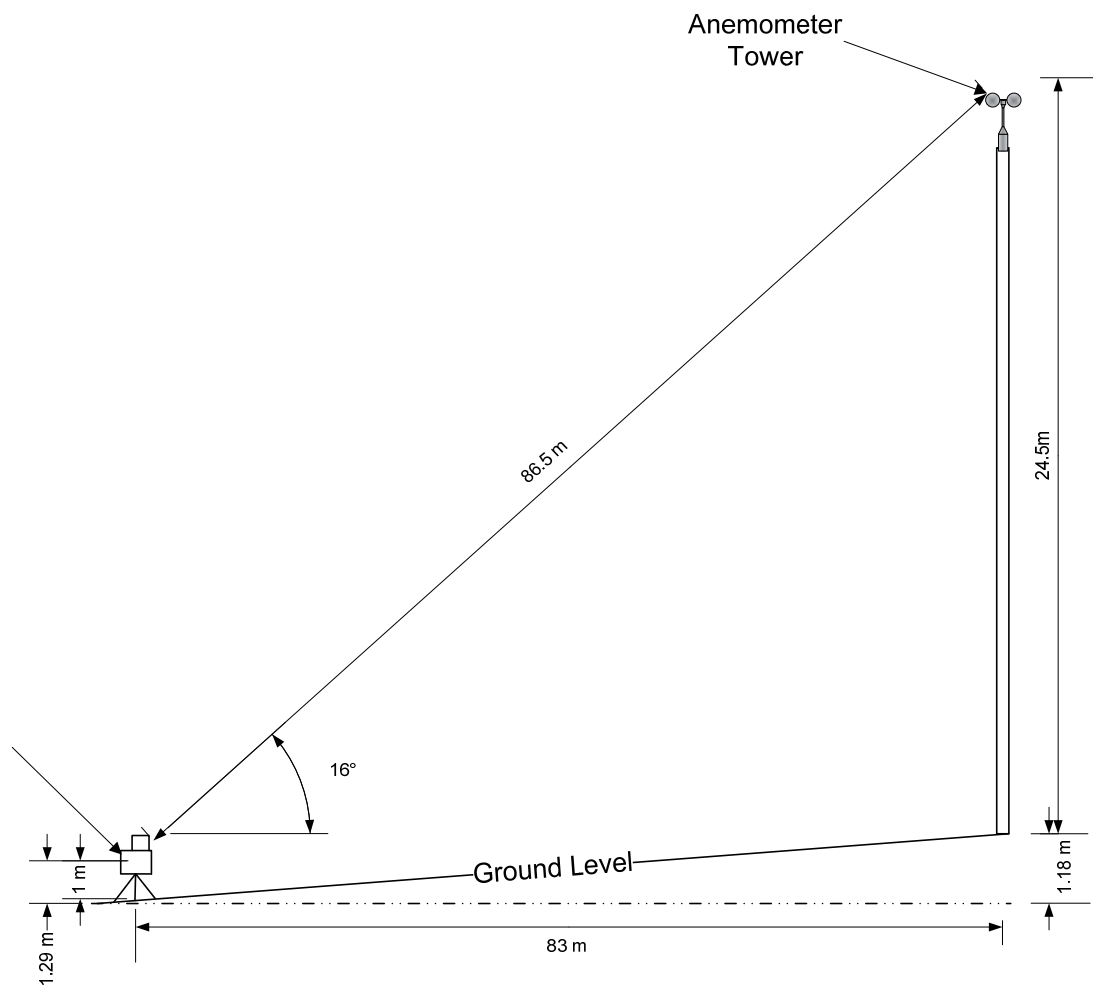


Figure 4 - 1 – Drawing showing distance from MET tower

5 TEST SITE

The WEICan Site is located on the northern tip of Prince Edward Island, at 47.055°N, 63.997°W. Situated on the coast of the Northumberland Strait, it has a 300 degree exposure to the ocean winds. WEICan Site is approximately 6 - 12 meters above sea level. Figure 5 - 2 shows a plot plan of the test site.

5.1 Photographs of Site



Figure 5 - 1 – Pictures of site taken from Vindicator™ Laser Wind Sensor position

5.2 Site Layout



Figure 5 - 2 - WEICan Site Topography

6 TEST EQUIPMENT

All test equipment meets IEC standards and was mounted accordingly.

6.1 Sensors and Data Acquisition System

Data Acquisition System:	Campbell Scientific CR21XL Ser#4202 with a SM16 Storage Module
Anemometers	Riso Model P2546A Ser#3470 & Ser#3471, replaced with Ser#4382 & Ser#4386
Temperature	Campbell Scientific Model 107 Ser# 41303
Barometric Pressure	RMYoung #61205V Ser#BP04834
Direction vane	Met1 020C Ser#G2561

See Appendix B for calibration sheets.

6.2 Description of Cup Anemometers

There are 4 anemometers located on the meteorological tower. The two anemometers used for the test are RISOE. The top one was mounted on a round vertical tube. The second one is mounted 320° relative to true north. There are two NRG anemometers located below the test anemometers. The data collected by these anemometers is not analyzed. They are installed for comparison purposes only.

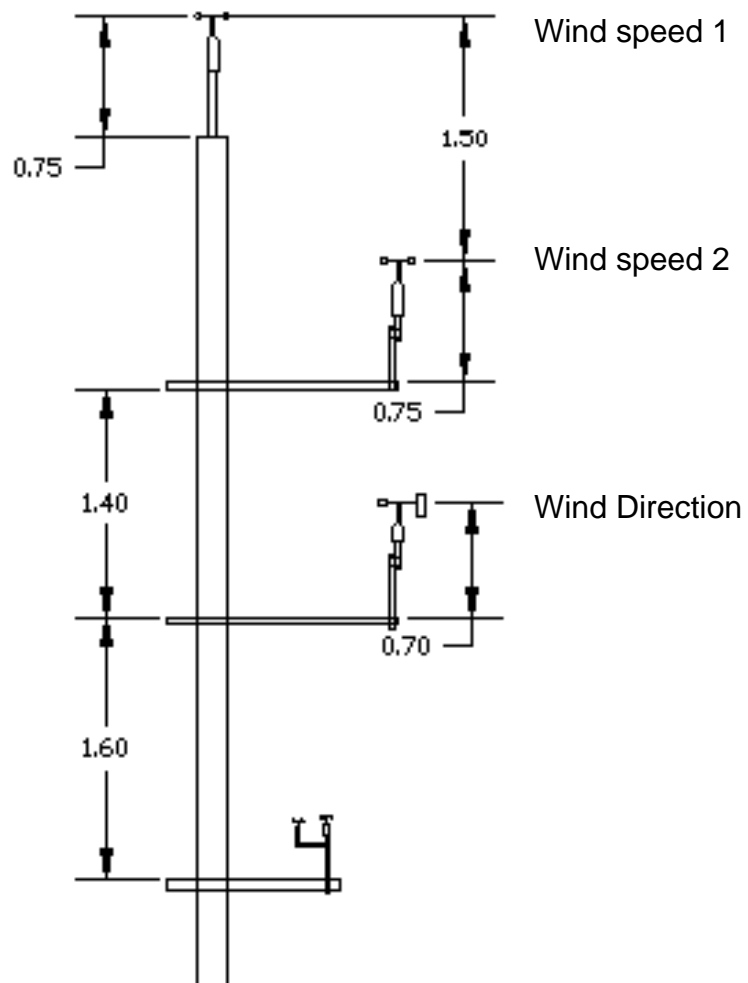


Figure 6 - 2 - Anemometer Configuration

6.3 Diagram of Meteorological Mast

Below is a diagram showing dimensions and orientation of sensors. The tower contains, from top to bottom: anemometer (wind speed 1), anemometer (wind speed 2), direction vane, two anemometers, temperature sensor and a barometric pressure sensor.

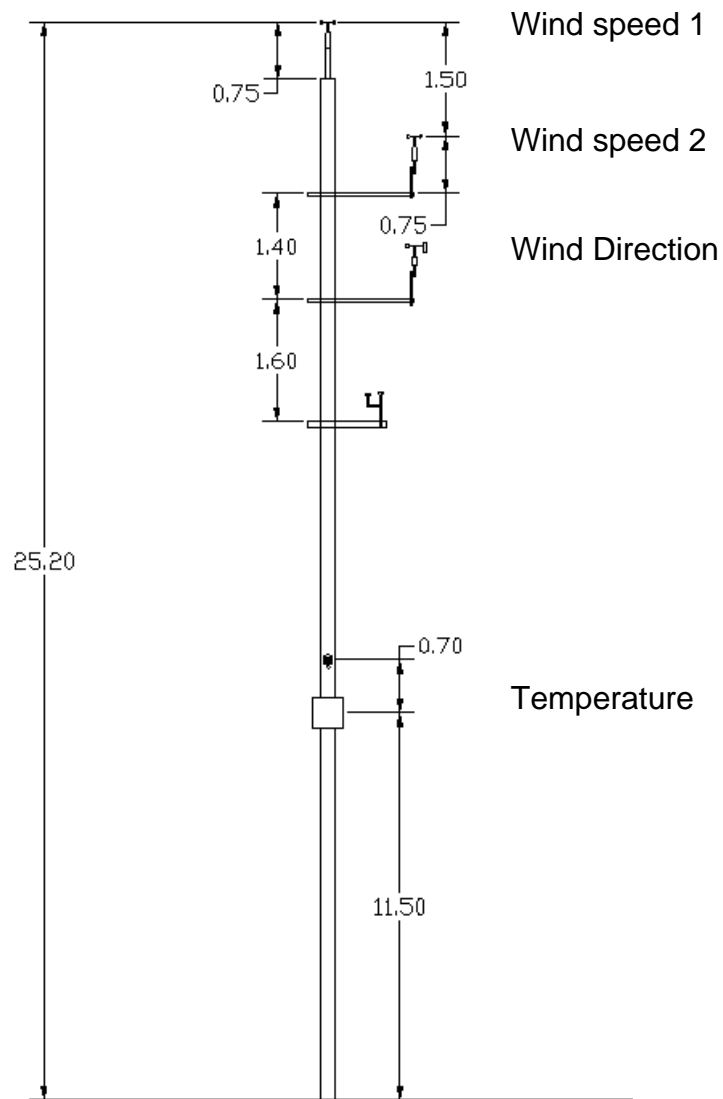


Figure 6 - 3 - Diagram of Meteorological Mast

7 MEASUREMENT PROCEDURE

7.1 Measurement Period

The measurement of data started on August 26, 2008 and continued through till August 28, 2008. The contiguous 42 hours of data is shown in the graphs in section 8.

Readings of wind speed, wind direction, system status and temperature were collected at a sampling rate of 1Hz (1-second data). From these one second readings, one minute groupings of contiguous data were derived. These one-minute groupings were ensured to be of a complete sixty seconds each. Average, standard deviation, maximum and minimum values were calculated for each one-minute data set.

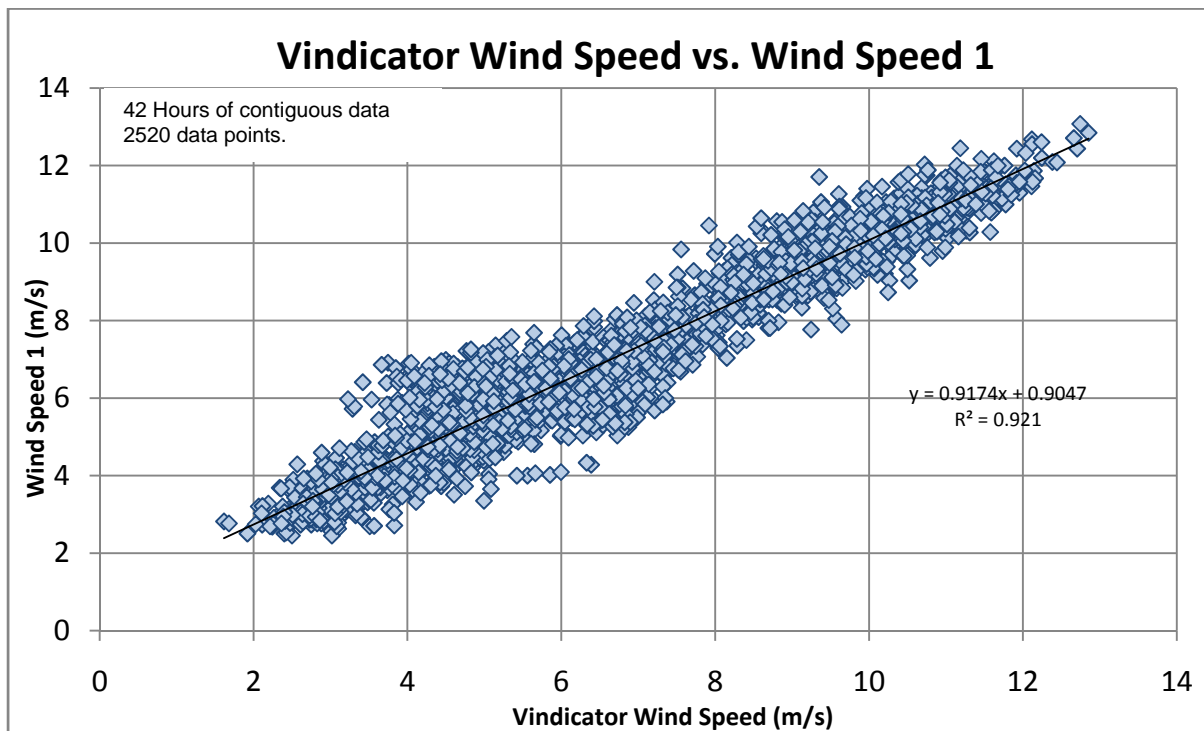
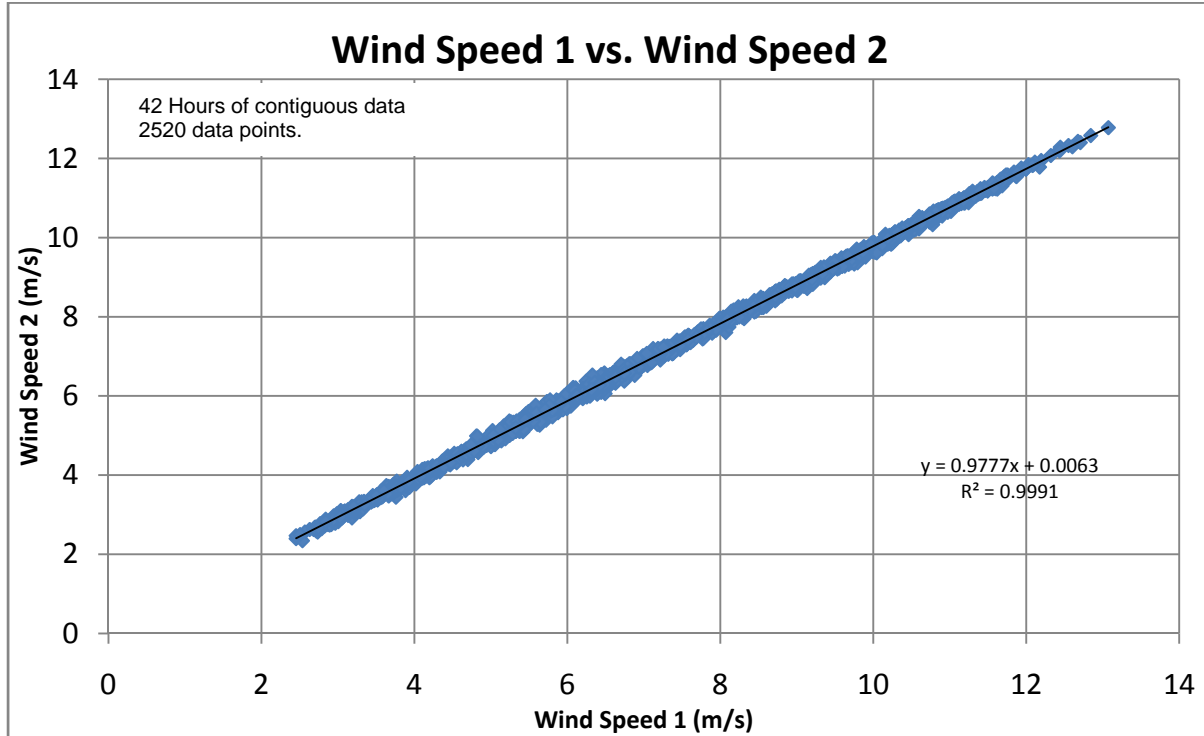
7.2 Data Rejection

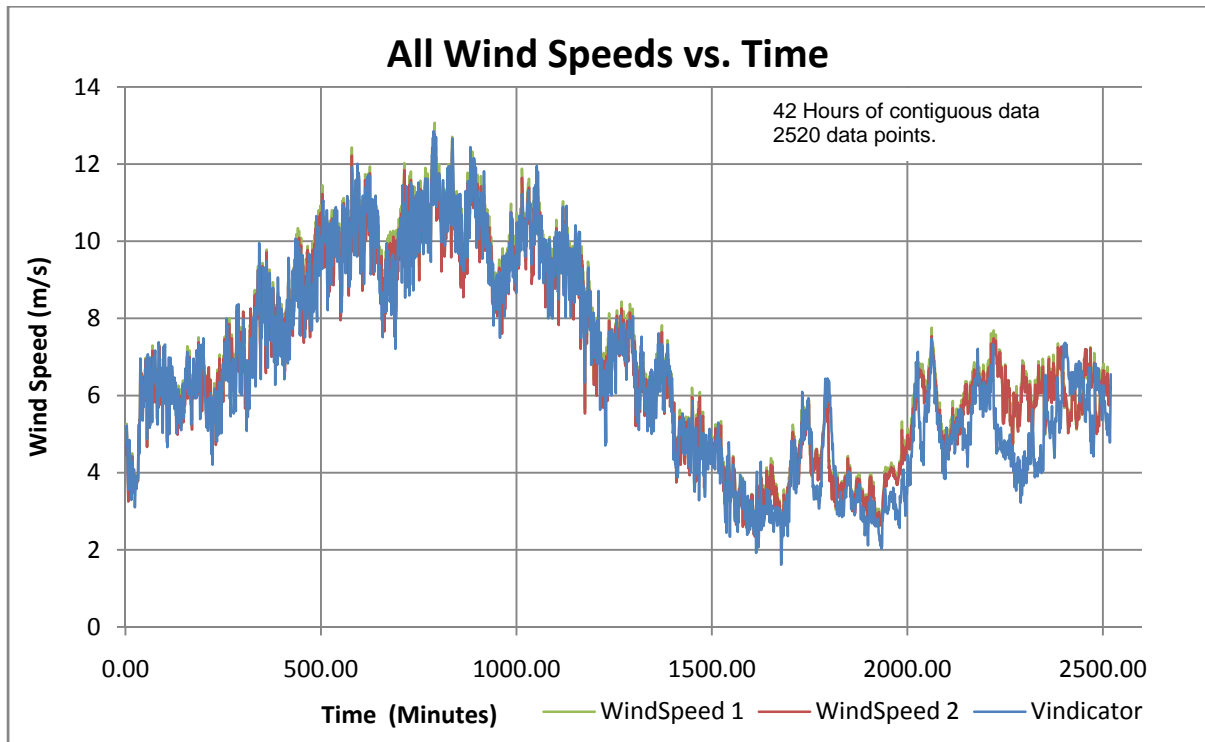
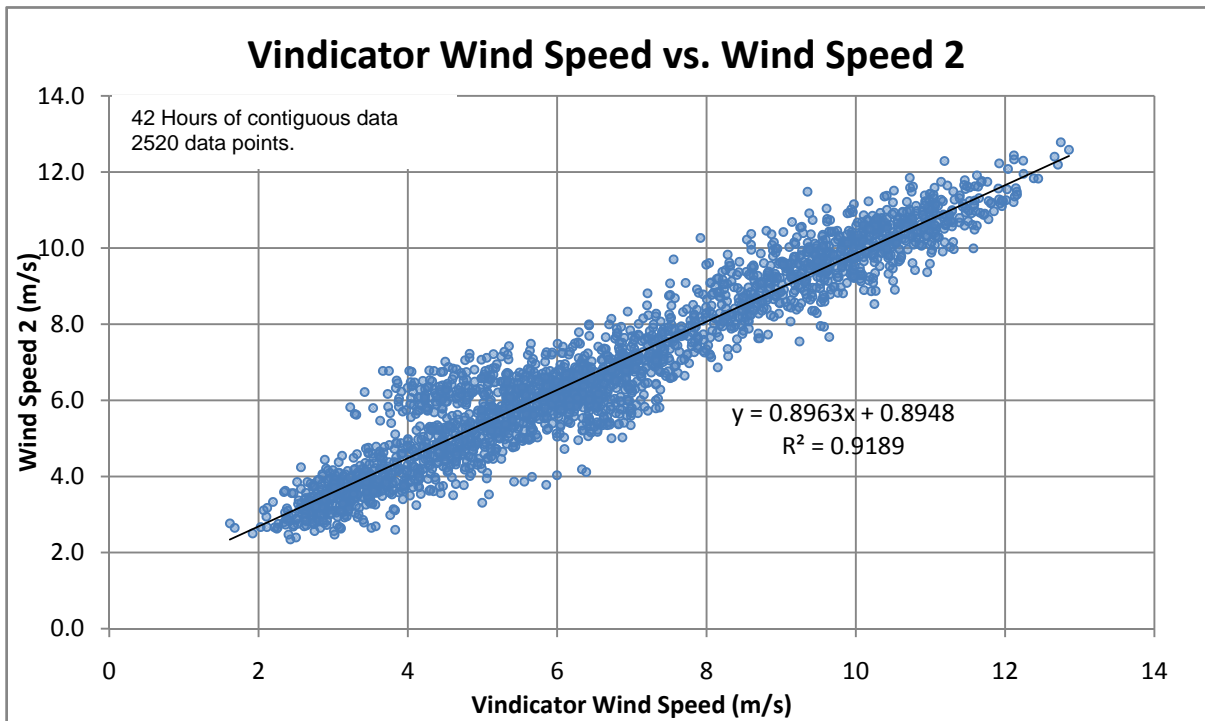
All data was reviewed and any data falling under the following circumstances were rejected:

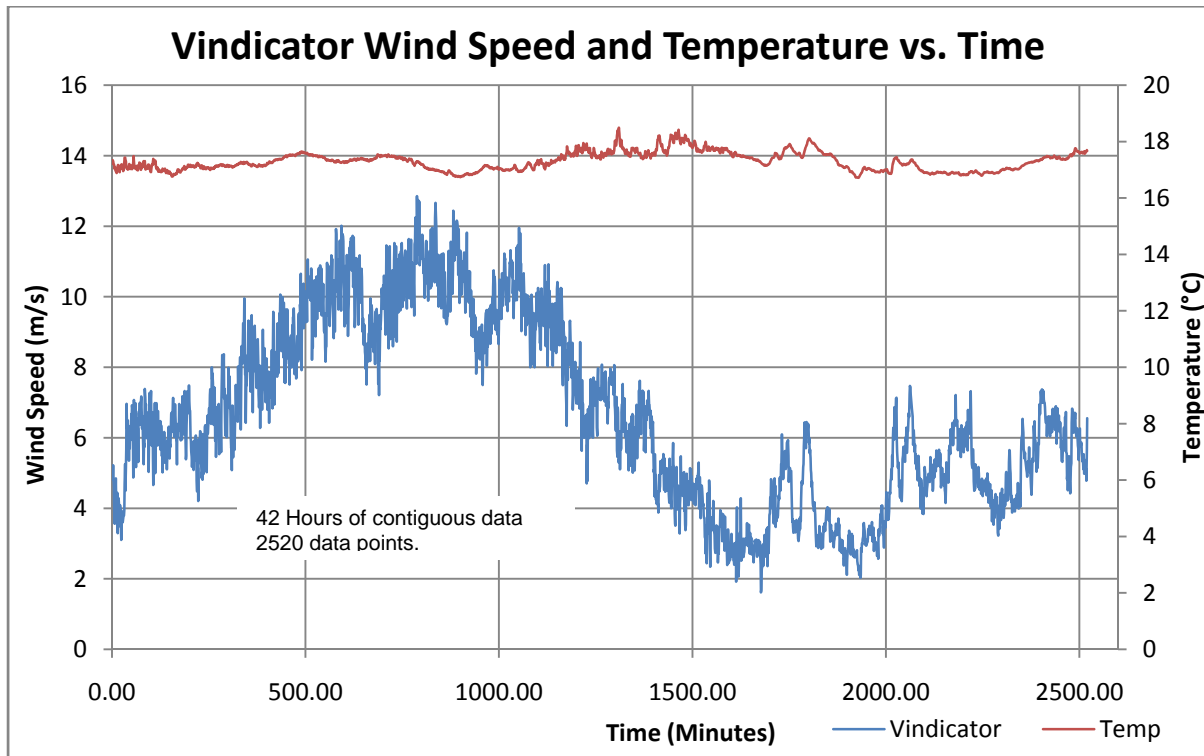
- The one minute averaged system status from the Vindicator™ Laser Wind Sensor indicated a signal to noise ratio below an acceptable threshold.
- Any data belonging to incomplete minutes.

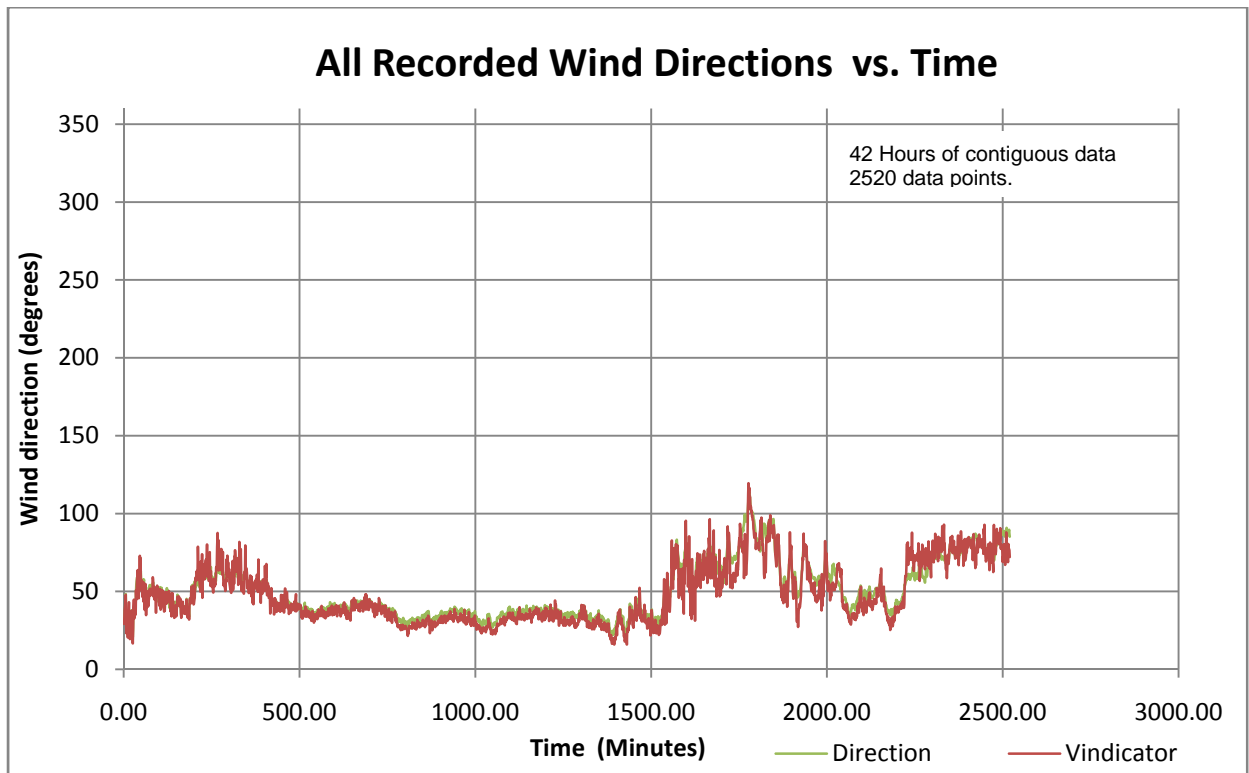
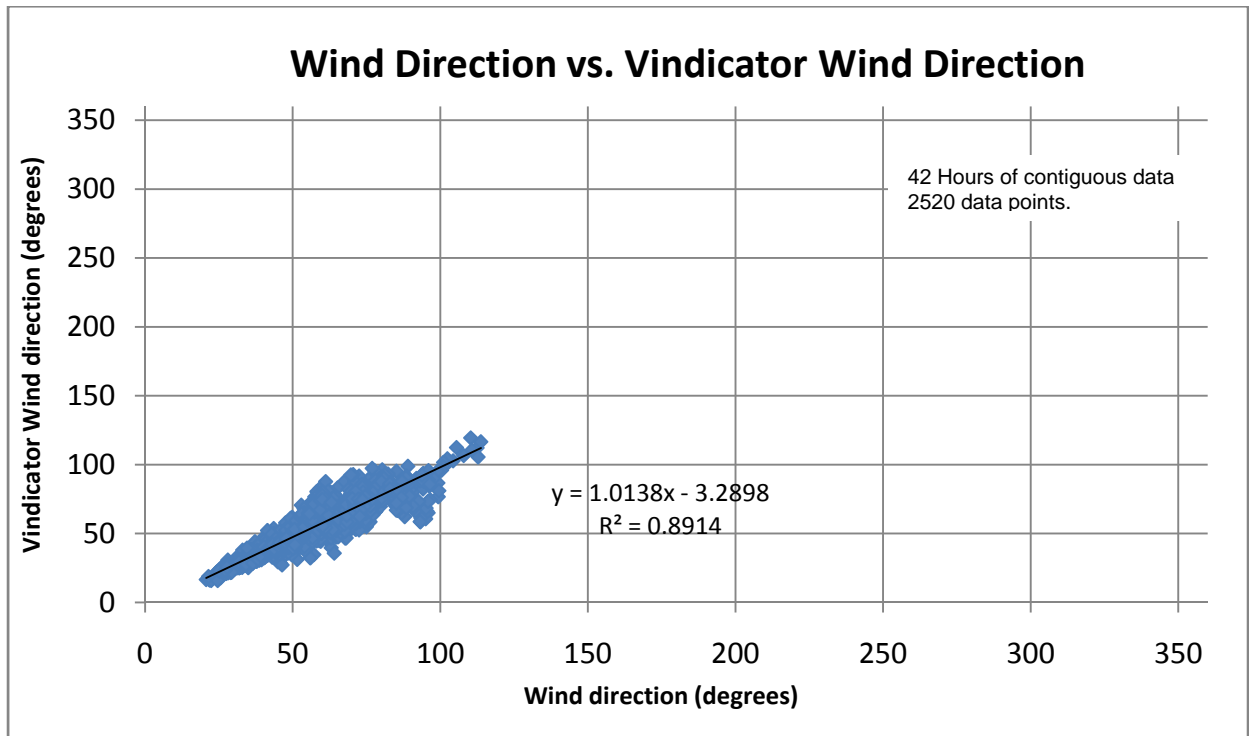
The collected data was contiguous with respect to the duration of the test, and no data points were rejected when compared to the qualifiers stated above.

8 MEASURED DATA









9 TEST SUMMARY

This test was conducted to determine that the Vindicator™ Laser Wind Sensor would function properly before placing on a wind turbine for phase two of the test. Since the data gave favorable results, it was decided to move the Vindicator™ Laser Wind Sensor onto the turbine for further testing.

Although the test confirmed the operation sufficient to move to the next phase of testing, it must be recognized that this test comprises a 42 hour period. Definitive conclusions on the correlation of the Vindicator™ Laser Wind Sensor with standard measurement will require an in depth testing program.

APPENDIX A: WIND PARAMETERS AT NORTH CAPE

Average annual wind speed at 50m: 8.2 m/s

Predominant wind direction: WNW – WSW

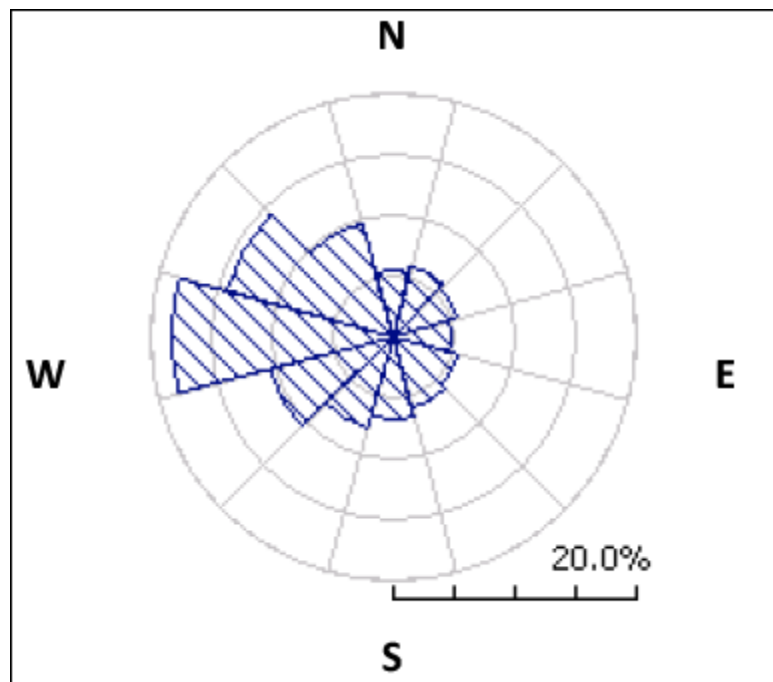


Figure A-1 - Diagram of WEICan wind rose at 50m

[Environment Canada meteorological site data](#)