DOE/GO/10460-Q

FIELD VERIFICATION PROGRAM FOR SMALL WIND TURBINES

Quarterly Report for the Period October – December 1999

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January 26, 2000

PREPARED FOR THE UNITED STATES
DEPARTMENT OF ENERGY
Under Cooperative Agreement
No. DE-FC36-99GO10460

DISCLAIMER

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Introduction

Windward Engineering has a Cooperative Agreement with the Department of Energy to install two Whisper 900 wind turbines, one at the NREL National Wind Technology Center and one at a test site near Spanish Fork, Utah. We will monitor the turbine in Spanish Fork for approximately three years and report energy production, availability, and general operating experience. In addition, we will create a computer model to predict the furling behavior of the Whisper 900. We will compare the predictions with measurements from the Utah test site.

This is the first quarterly report on this project. The report is organized according to the Statement of Work. We will discuss progress in each task area in the paragraphs that follow.

Task 1. Install two turbines and repair as needed

This task has been the focus of activity during the first quarter. We have nearly completed both installations. Specifically, we have completed the following:

1) Executed a formal agreement with Utah Municipal Power Agency for use of the test site for three years.
2) Purchased and taken delivery of two Whisper 900 turbines and associated tower components, inverters, and battery banks.
3) Completed and received approval of all required NREL ES&H documents in order to install and test the turbine at the NWTC.
4) Had a foundation designed by a licensed Professional Engineer and completed installation of the foundation, guy anchors, winch system, lightning protection grounding system, underground conduit, and associated electrical equipment for the turbine and meteorological tower for the turbine in Spanish Fork.
5) Installed the turbine and meteorological towers in Spanish Fork. Installed the wind sensors and NRG data logger.
6) Selected and placed orders for most of the instrumentation and data acquisition system for use in Spanish Fork.
7) Completed the installation and electrical connection of the turbine at the NWTC. Received ES&H approval to begin testing of the turbine. NREL staff are currently instrumenting the turbine and preparing for testing.

During the next quarter we plan to finish installing and instrumenting the turbine and begin routine monitoring in Spanish Fork. We have completed all of the necessary NREL/NWTC activities other than providing support for repair and maintenance of the turbine as needed. (We completed the installation of the Spanish Fork turbine in January—after the period of this report but before this report was written. Photos of the two machines are shown in Appendix A.)

Task 2. Phase I testing and analysis

In this task we will conduct moderately intensive testing of the performance and furling behavior of the turbine for six months. We will also develop an ADAMS computer model of the turbine, predict the furling behavior in wind conditions measured at the test site, and compare the predictions with measurements. During the first quarter we completed the following:

1) Measured mass and natural frequency properties of the Whisper 900 for use in creating the ADAMS model.

2) Developed a web site that we will use to display summary test results. The basic site is now in place, though the pages pertaining to the Whisper testing cannot be completed until we begin to gather test data. The web site can be viewed at www.windwardengineering.com.

This task will be the primary focus of our attention during the next quarter. We plan to begin publishing test results on the web site, to complete the computer model of the system, and to begin comparisons with of simulations and test results.

Task 3. Phase II testing and analysis

In this task we will continue to monitor the turbine performance for approximately one year after the completion of Task 2, though at a less intensive level than in Task 2. No work was planned or completed in this task area during the current quarter.

Task 4. Phase III testing and analysis

In this task we will continue to monitor the turbine performance until the end of the contract, though at a less intensive level than in Task 3 No work was planned or completed in this task area during the current quarter.

Task 5. Turbine removal and inspection

No work was planned or completed in this task area during the current quarter.

Task 6. Reporting and Administration

The project has been proceeding smoothly with no particular problems to report.

We have decided to not submit a paper for the next AWEA conference. The abstracts were due in January and papers are due by the end of April. We concluded that we would not have enough test data by that time to provide the basis for a solid paper. We plan to submit our results to the AWEA conferences in 2001 and 2002.

Appendix A

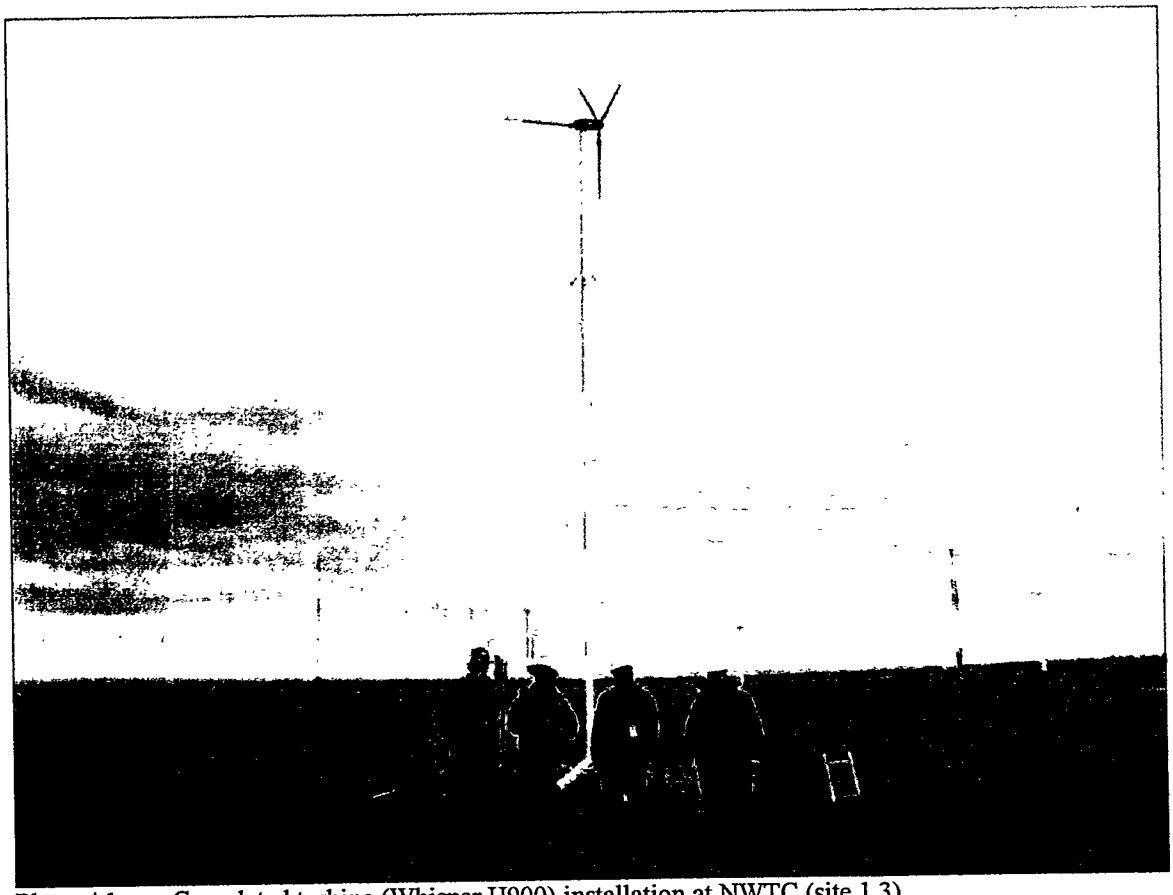

Photo A1. Completed turbine (Whisper H900) installation at NWTC (site 1.3).

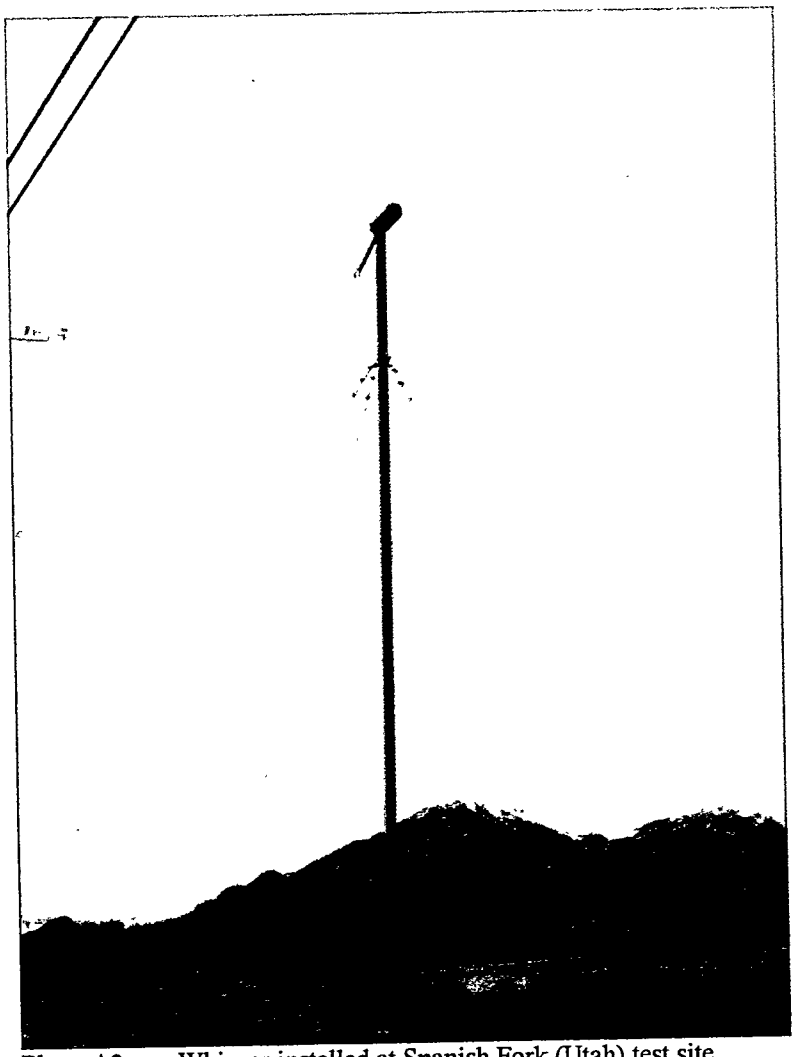

Photo A2. Whisper installed at Spanish Fork (Utah) test site.

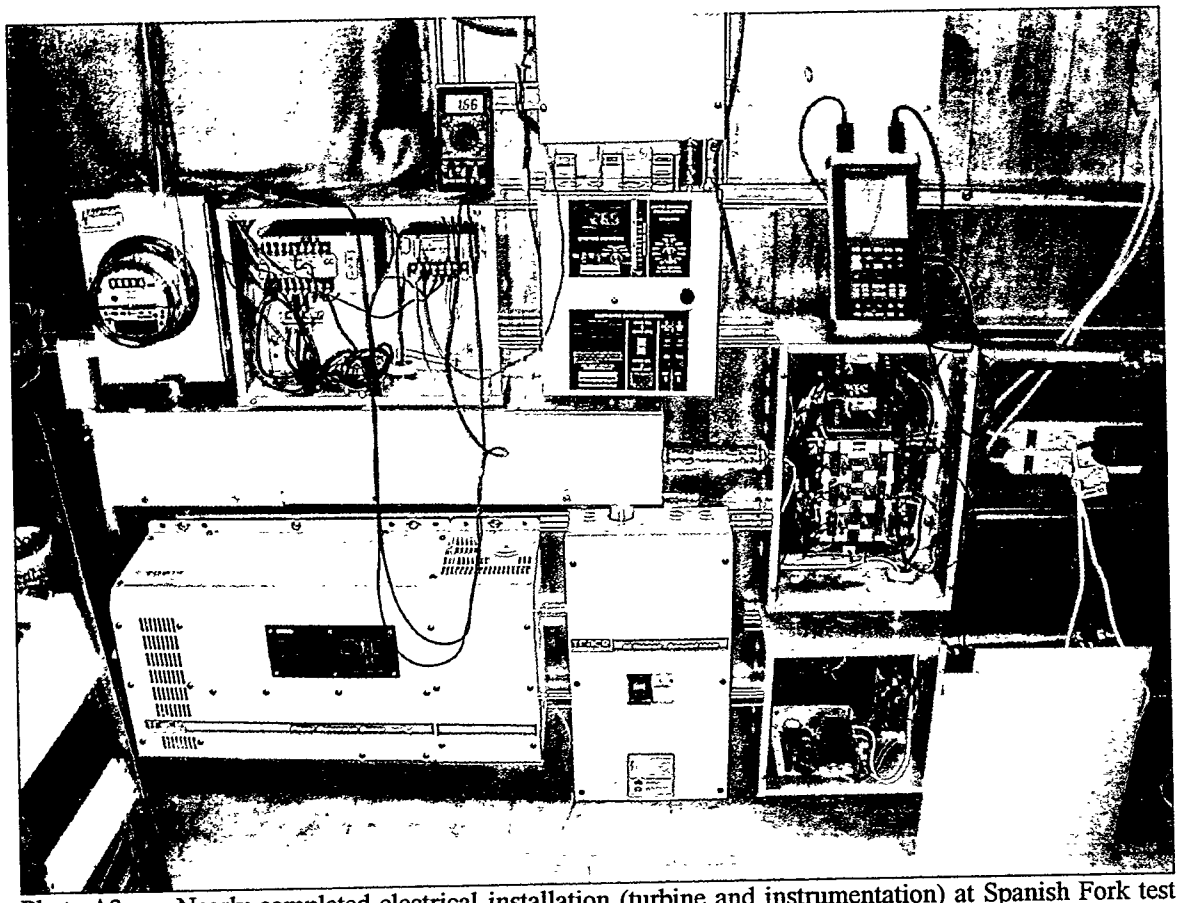

Photo A3. Nearly completed electrical installation (turbine and instrumentation) at Spanish Fork test site.