

Abstract Submitted
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Towards an Experimental Investigation of Wind Turbine Aerodynamics at Full Dynamic Similarity MARK A. MILLER, MARCUS HULTMARK, Princeton University — As horizontal axis wind turbines continue to increase in size (with the largest approaching 200 meters in diameter) it becomes progressively more difficult to test new designs without high computational power or extensive experimental effort using conventional tools. Therefore, compromises are often made between the important non-dimensional parameters (Reynolds number and Strouhal number, or tip speed ratio) so that reasonable engineering insight can be gained. Using the unique facilities available at Princeton University, we aim to match both non-dimensional parameters and thus achieve full dynamic similarity at realistic conditions. This is accomplished by using the High Reynolds number Test Facility (or HRTF), which is a high pressure (200 atmospheres) wind tunnel. We present the design, manufacture, and testing of an apparatus suited to the unique environment of a high-pressure facility as well as future plans for investigating the underlying aerodynamics of large-scale wind turbines.

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