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Experimental Study of Fully Developed Wind Turbine Array Boundary Layer JOHN TURNER V, MARTIN WOSNIK, Univ of New Hampshire — Results from an experimental study of an array of up to 100 model wind turbines with 0.25 m diameter, conducted in the turbulent boundary layer of the 6.0 m wide x 2.7 m tall x 72.0 m long test section of the UNH Flow Physics Facility, are reported. The study aims to address two questions. First, for a given configuration (turbine spacing, initial conditions, etc.), when will the model wind farm reach a "fully developed" condition, in which turbulence statistics remain the same from one row to the next within and above the wind turbine array. Second, how is kinetic energy transported in the wind turbine array boundary layer (WTABL). Measurements in the fully developed WTABL can provide valuable insight to the optimization of wind farm energy production. Previous experimental studies with smaller model wind farms were unable to reach the fully developed condition. Due to the size of the UNH facility and the current model array, the fully developed WTABL condition can be achieved. The wind turbine array was simulated by a combination of drag-matched porous disks, used in the upstream part of the array, and by a smaller array of realistic, scaled 3-bladed wind turbines immediately upstream of the measurement location.

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