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The Penn State "Cyber Wind Facility" JAMES BRASSEUR, GANESH VIJAYAKUMAR, ADAM LAVELY, TARAK NANDI, BALAJI JAYARAMAN, PANKAJ JHA, ALEX DUNBAR, JAVIER MOTTA-MENA, Penn State, SUE HAUPT, NCAR, BRENT CRAVEN, ROBERT CAMPBELL, SVEN SCHMITZ, ERIC PATERSON, Penn State — We describe development and results from a first generation Penn State "Cyber Wind Facility" (CWF). The aim of the CWF program is to develop and validate a computational "facility" that, in the most powerful HPC environments, will be basis for the design and implementation of cyber "experiments" at a level of complexity, fidelity and resolution to be treated similarly to field experiments on wind turbines operating in true atmospheric environments. We see cyber experiments as complimentary to field experiments in the sense that, whereas field data can record over ranges of events not representable in the cyber environment, with sufficient resolution, numerical accuracy, and HPC power, it is theoretically possible to collect cyber data from more true, albeit canonical, atmospheric environments can produce data from extraordinary numbers of sensors impossible to obtain in the field. I will describe our first generation CWF, from which we have quantified and analyzed useful details of the interactions between atmospheric turbulence and wind turbine loadings for an infinitely stiff commercial-scale turbine rotor in a canonical convective daytime atmospheric boundary layer over horizontally homogeneous rough flat terrain. Supported by the DOE Offshore Initiative and the National Science Foundation.

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