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Performance Characteristics of a Cross-Flow Hydrokinetic Turbine under Unsteady Conditions KAREN FLACK, ETHAN LUST, BEN BAILIN, United States Naval Academy — Performance characteristics are presented for a cross-flow hydrokinetic turbine designed for use in a riverine environment. The test turbine is a 1:6 scale model of a three-bladed device (9.5 m span, 6.5 m diameter) that has been proposed by the Department of Energy. Experiments are conducted in the large towing tank (116 m long, 7.9 m wide, 5 m deep) at the United States Naval Academy. The turbine is towed beneath a moving carriage at a constant speed in combination with a shaft motor to achieve the desired tip speed ratio (TSR) range. The measured quantities of turbine thrust, torque and RPM result in power and thrust coefficients for a range of TSR. Results will be presented for cases with quiescent flow at a range of Reynolds numbers and flow with mild surface waves, representative of riverine environments. The impact of unsteady flow conditions on the average turbine performance was not significant. Unsteady flow conditions did have an impact on instantaneous turbine performance which operationally would result in unsteady blade loading and instantaneous power quality.

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