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Experimental Investigation of a Helicopter Rotor Hub Wake DAVID REICH, The Pennsylvania State University Department of Aerospace Engineering, BRIAN ELBING, The Pennsylvania State University Applied Research Laboratory, SVEN SCHMITZ, The Pennsylvania State University Department of Aerospace Engineering — A scaled model of a notional helicopter rotor hub was tested in the 48" Garfield Thomas Water Tunnel at the Applied Research Laboratory Penn State. The main objectives of the experiment were to understand the spatial- and temporal content of the unsteady wake downstream of a rotor hub up to a distance corresponding to the empennage. Primary measurements were the total hub drag and velocity measurements at three nominal downstream locations. Various flow structures were identified and linked to geometric features of the hub model. The most prominent structures were two-per-revolution (hub component: scissors) and four-per-revolution (hub component: main hub arms) vortices shed by the hub. Both the two-per-revolution and four-per-revolution structures persisted far downstream of the hub, but the rate of dissipation was greater for the four-per-rev structures. This work provides a dataset for enhanced understanding of the fundamental physics underlying rotor hub flows and serves as validation data for future CFD analyses.

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