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BIOGRAPHY

Kevin L Koudela has led the design, fabrication and demonstration of multiple composite and hybrid composite prototypes for operational evaluation and has taught courses in composites, structural analysis and finite element analysis at The Pennsylvania State University, USA. He was the author or co-author of 24 referred journals and 43 technical proceeding articles and serves as a technical reviewer for the *Journal of Composite Materials, Journal of Composites Technology and Research, ASTM and ASME*. He was awarded the Navy Meritorious Civilian Service Award and was a co-recipient of the Defense Manufacturing Technology (ManTech) Achievement Award by the US Office of Naval Research.

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DESIGN OF AN EMERGENT NET SHAPE FABRICATED THREE BLADE COMPOSITE ONE PIECE ROTORS FOR CAPEX AND OPEX REDUCTIONS

Marine Hydro Kinetic (MHK) turbines have shown promise as a method for harvesting energy from natural waterways. However, excessive fabrication and assembly and high life-cycle costs often preclude implementation of these energy harvesting devices. As such, our design process is focused on mitigation of implementation challenges by designing a novel low-cost, net shape fabricated single piece composite three-blade MHK turbine rotor to minimize both Capital Expenditures (CAPEX) and Operational Expenditures (OPEX) to enable cost of energy improvements. We believe that we are able achieve these cost reductions by leveraging our successfully demonstrated rapid design protocol, underpinned by our team-based concurrent engineering design approach, whereby we incorporate all key technology disciplines including selection of materials, implementation of robust design methods, ply kitting strategies for ease of blade manufacture, recommended non-destructive inspection methods and design of test and evaluation methods from rotor concept design through single piece composite rotor prototype detailed design. Author's presentation provides a summary of the three key emergent processes associated with our prototype design evolution: Design for turbine rotor manufacturability using computational fluid dynamics and finite element analysis; single piece composite turbine rotor net shape fabrication protocol and coupon and prototype threshold fatigue test methods to ensure MHK rotor structural robustness. They envision that this innovative team-based concurrent engineering approach will enable us to reduce CAPEX by eliminating complex assemblies and rotor machining while mitigating OPEX by use of non-corrosive e-glass/epoxy composite materials and implementing our state-of-the-art threshold fatigue design protocol to prevent onset of material degradation over the life of the MHK turbine rotor.