Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

On the vortex ring state RICHARD GREEN, E. GILLIES, M. GIUNI, J. HISLOP, Univ of Glasgow, OMER SAVAS, University of California at Berkeley — The investigation considers the vortex ring state, a phenomenon normally associated with the collapse of a trailing, helical vortex wake into a unstable vortex ring, and is a problem encountered when a helicopter rotor descends into its own wake. A series of wind tunnel and towing tank experiments on rotor systems have been performed, and a comparison is then made with the behaviour of a specially designed open core, annular jet system that generates a mean flow velocity profile similar to that observed below a rotor. In experimentally simulated descents the jet system forms flow patterns that are topologically similar to the vortex ring state of a rotor system. Furthermore the dynamic behaviour of the flow shares many of the important characteristics of the rotor flow. This result suggests that the phenomenon of the vortex ring state of a rotor wake is decoupled from the detailed vortex dynamics of the helical vortex filaments themselves. The presentation will describe the principle behind the investigation, the details of the annular jet system and the results gained using PIV and flow visualisation of the wake and jet systems.

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Date submitted: 11 Jul 2014 Electronic form version 1.4