

Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Transition of a Swirling Vortex from the One-celled to Two-celled Structure CHIN-CHOU CHU, SHIH-LIN HUANG, CHIEN-CHENG CHANG, HUNG-CHENG CHEN, INSTITUTE OF APPLIED MECHANICS, NATIONAL TAIWAN UNIVERSITY, TAIPEI , TAIWAN, ROC COLLABORATION, DIVISION OF MECHANICS, RESEARCH CENTER FOR APPLIED SCIENCE, ACADEMIA SINICA, TAIPEI , TAIWAN, ROC COLLABORATION — In this study, we investigate the transition of a swirling vortex from a one-celled to two-celled vortex structure during its formation in a rotating tank. The main idea is to initiate the flow by siphoning fluid out of the tank and then lift the siphoning mechanism off the water all of a sudden. This life cycle of the swirling vortex can be roughly divided into three stages. (1) The stage of siphoning induces the formation of the one-celled vortex. (2) The stage of downward jet impingement triggers the transition of the vortex. (3) The stage of detachment of the inner cell leads to a cup-like recirculation zone, pushed upward by an up-drafting boundary layer flow. The sequence of complex flow behaviors enables us to correlate the time history of the swirling vortex to an existing conceptual model for tornadoes, and to uncover some results not confirmed or observed before.

Chin-Chou Chu

Date submitted: 04 Aug 2006

Electronic form version 1.4