Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Mechanism of air entrainment in deep-water hydraulic jump ALBERTO ALISEDA, Universidad Carlos III de Madrid, JAVIER RODRIGUEZ-RODRIGUEZ, JUAN LASHERAS, Dept. of MAE. University of California, San Diego — Based on experimental observations, we propose a new mechanism for air entrainment in a deep-water hydraulic jump. It is shown that in a region close to the toe of the jump, the coherent flow structures resemble those in two-dimensional mixing layers widely described in the literature. In the entrainment region, properly defined local Froude and Weber numbers are very high, thus buoyancy and surface tension effects can be neglected as a first approximation. We show that air entrainment is produced by the engulfment of big cavities of "fresh fluid" by coherent structures. By extending available models of the mixing layer to the large density ratio present in a hydraulic jump, the air entrainment in this type of flows can be estimated. PIV measurements of the velocity field in an attatched deep-water hydraulic jump as well as high-speed visualizations are presented to support the proposed mechanism. The structure of this mixing layer collapses at a certain distance downstream, as the local Froude number decreases and buoyancy effects are no longer negligible. At this point, where the majority of air entrainment has occurred, this mechanism no longer contributes to the overal increase in void fraction.

Juan Lasheras
Dept. MAE. University of California, San Diego

Date submitted: 22 Sep 2005 Electronic form version 1.4