Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

An Investigation of Hydrodynamic Instabilities in Wind-Driven Flames COLIN MILLER, SALMAN VERMA, ARNAUD TROUVE, Univ of Maryland-College Park, MARK FINNEY, JASON FORTHOFER, SARA MCALLISTER, USDA Forest Service, Missoula Fire Sciences Lab, MICHAEL GOLLNER, Univ of Maryland-College Park — Recent findings on the importance of convective heating by direct flame contact in wildland fire spread have highlighted the importance of fluid dynamics in the flame spread process. Researchers have observed several dominant coherent structures in the three-dimensional flame in both small and large-scale experiments. This experimental study seeks an understanding of the physical mechanisms by which coherent structures are induced by hydrodynamic instabilities. Experimental data is derived from both a nonreactive hot plate and a stationary burner in a well-characterized laminar flow wind tunnel. Streamwise vortices promote upwash and downwash regions of the flow, and scaling analyses of temperature and velocity maps are proposed. Emphasis is placed on elucidating the regimes in which certain instability mechanisms dominate. The relative strength of shear forces and buoyant forces at certain locations in the boundary layer are examined as contributors to behavior analogous to Klebanoff modes, Gortler vortices, Rayleigh-Taylor instabilities, or Tollmien-Schlichting waves. To further supplement experimental results, comparisons to numerical simulations of hot plates will be made.

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Date submitted: 29 Jul 2015 Electronic form version 1.4