**Turbulence in Supercritical \( \text{O}_2/\text{H}_2 \) and \( \text{C}_7\text{H}_{16}/\text{N}_2 \) Mixing Layers**

This report presents a study of numerical simulations of mixing layers developing between opposing flows of paired fluids under supercritical conditions, the purpose of the study being to elucidate chemical-species-specific aspects of turbulence. The simulations were performed for two different fluid pairs — \( \text{O}_2/\text{H}_2 \) and \( \text{C}_7\text{H}_{16}/\text{N}_2 \) — at similar reduced initial pressures (reduced pressure is defined as pressure \( \div \) critical pressure). Thermodynamically, \( \text{O}_2/\text{H}_2 \) behaves more nearly like an ideal mixture and has greater solubility, relative to \( \text{C}_7\text{H}_{16}/\text{N}_2 \), which departs strongly from ideality. Because of a specified smaller initial density stratification, the \( \text{C}_7\text{H}_{16}/\text{N}_2 \) layers exhibited greater levels of growth, global molecular mixing, and turbulence. However, smaller density gradients at the transitional state for the \( \text{O}_2/\text{H}_2 \) system were interpreted as indicating that locally, this system exhibits enhanced mixing as a consequence of its greater solubility and closer approach to ideality. These thermodynamic features were shown to affect entropy dissipation, which was found to be larger for \( \text{O}_2/\text{H}_2 \) and concentrated in high-density-gradient-magnitude regions that are distortions of the initial density-stratification boundary. In \( \text{C}_7\text{H}_{16}/\text{N}_2 \), the regions of largest dissipation were found to lie in high-density-gradient-magnitude regions that result from mixing of the two fluids.

*This work was done by Josette Bellan, Kenneth Harstad, and Nora Okong’o of Caltech for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-30561*