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Turbulent Coherent Structures in a Thermally Stable Boundary Layer OWEN WILLIAMS, SEAN BAILEY, ALEXANDER SMITS, Princeton University — An experiment was conducted to examine the effect of thermal stability on turbulent coherent structures occurring in a flat plate boundary layer. The objective is to further characterize the turbulence in thermally stable atmospheric boundary layers, commonly found in the arctic regions, focusing on Reynolds number independent effects. This experiment was conducted in a 16 foot long, 4'x2' cross-section, open-return wind tunnel by replacing the upper surface with a heated half inch aluminum plate. The plate was maintained at an isothermal condition, the boundary layer along this surface was tripped and the tunnel run at the lowest speed possible, in order to maintain both a fully turbulent boundary layer and a large Richardson number. A wide range of stabilities were investigated, with Richardson numbers ranging from 0 to 0.5, covering both the weakly and strongly stable regimes. Using thermocouple temperature measurements and time resolved particle image velocimetry; an attempt was made to identify changes in coherent turbulent motions corresponding to changing flow stability. Additionally, an attempt was made to identify significant features of the turbulence that could be used to identify clearly delineating features of the weakly stable and strongly stable flow regimes.

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