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Flat Plate Boundary Layer Stimulation Using Trip Wires and Hama Strips. CHARLES PEGUERO, Naval Surface Warfare Center, Carderock Division, CHARLES HENOCH, JAMES HRUBES, ALBERT FREDETTE, RAYMOND ROBERTS, STEPHEN HUYER, Naval Undersea Warfare Center, Newport Division — Water tunnel experiments on a flat plate at zero angle of attack were performed to investigate the effect of single roughness elements, i.e., trip wires and Hama strips, on the transition to turbulence. Boundary layer trips are traditionally used in scale model testing to force a boundary layer to transition from laminar to turbulent flow at a single location to aid in scaling of flow characteristics. Several investigations of trip wire effects exist in the literature, but there is a dearth of information regarding the influence of Hama strips on the flat plate boundary layer. The intent of this investigation is to better understand the effects of boundary layer trips, particularly Hama strips, and to investigate the pressure-induced drag of both styles of boundary layer trips. Untripped and tripped boundary layers along a flat plate at a range of flow speeds were characterized with multiple diagnostic measurements in the NUWC/Newport 12-inch water tunnel. A wide range of Hama strip and wire trip thicknesses were used. Measurements included dye flow visualization, direct skin friction and parasitic drag force, boundary layer profiles using LDV, wall shear stress fluctuations using hot film anemometry, and streamwise pressure gradients. Test results will be compared to the CFD and boundary layer model results as well as the existing body of work. Conclusions, resulting in guidance for application of Hama strips in model scale experiments and non-dimensional predictions of pressure drag will be presented.

Charles Peguero
Naval Surface Warfare Center

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