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Experiments and NPSE of roughness receptivity in swept-wing boundary layers[1] WILLIAM SARIC, MATTHEW WOODRUFF, HELEN REED, Texas A&M University — New data are presented on 3-D boundary-layer receptivity to roughness in low-disturbance environments. The measurements include infrared thermography with calibrated and temperature-compensated hotfilms to study roughness-related issues of boundary-layer transition in flight. A swept-wing model is mounted on the wing of a Cessna O-2 aircraft where nonlinear parabolized stability equations (NPSE) correlate the stability measurements and transition locations. The laminarization scheme of spanwise-periodic discrete roughness elements (DRE) is investigated at chord Reynolds numbers of 7.5 million. Flight experiments were conducted where the surface roughness amplitude was varied from 6 to 50 microns while the disturbance shear-stress was measured with calibrated hotfilm gauges in two locations: x/c= 15% and 30%; the former in the linear range and the later in the nonlinear range. In this way, the disturbance velocity amplitude was calculated as a function of roughness Reynolds number. These data were then used as initial conditions for the NPSE calculations to determine the efficacy of the DREs. The work was supported by: AFOSR Grant FA9550-05-0044, AFRL, and NASA Langley Research Center.

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William Saric
Texas A&M University

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