Flight experiments on laminar flow control in swept-wing boundary layers
(An unlikely journey of a mechanician)

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Abstract
Data are presented on boundary-layer transition to turbulence in low-disturbance flight environments. The measurements include infra-red thermography and hotfilm anemometry to study roughness-related issues of boundary-layer transition on a swept-wing model that is mounted on the wing of a Cessna O-2 aircraft. A Navier-Stokes solution is used calculate the aircraft flowfield and boundary layer while Nonlinear Parabolized Stability Equations (NPSE) quantify the stability measurements and transition locations. The laminarization scheme of spanwise-periodic distributed roughness elements (DRE) is investigated at chord Reynolds numbers of 8 million. Measurements were made to determine the transition locations for clean configurations and for enhanced surface roughness that simulates an operational surface finish. For clean configurations, natural laminar flow was achieved over 80% of the surface of a 37° swept-wing model at chord Reynolds numbers of 8.1 million. With a background surface roughness of 1 μm rms, transition moved forward to 30% chord. The DRE delayed transition to 60% chord.

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Bio
William S. Saric is the Stewart & Stevenson Professor of Aerospace Engineering at Texas A&M University where he has been since Jan 2005. He received his PhD in Mechanics from the Illinois Institute of Technology in 1968 and has held appointments at Sandia Laboratories (Atomic & Fluid Physics, 1963-66, 1968-75), Virginia Polytechnic Institute & State University (Engineering Science & Mechanics, 1975-84), Tohoku University, Japan (Aeronautics & Astronautics, 1991-92), and Arizona State University (Mechanical & Aerospace Engineering, 1984-2005). He a member of the National Academy of Engineering and The Academy of Medicine, Engineering, and Science of Texas. He received the AIAA Fluid Dynamics Award in 2003, the SES G.I. Taylor Medal in 1993, the AGARD (NATO) Scientific Achievement Award in 1996, IIT Alumni Recognition Award in 2005, and the Alumni Research Award from V.P.I.&S.U in 1984. He is a Fellow of AIAA and APS, and a Life Fellow of ASME. He is presently re-establishing two major wind tunnels and a flight research laboratory at Texas A&M University. Most recently, he has conducted computational, experimental, and flight research on stability, transition, and control of 2-D and 3-D boundary layers. He is also conducting stability experiments on temporally modulated Taylor-Couette flow.