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Technical Comments

Brief discussion of previous investigations in the aerospace sciences and technical comments on papers published in the Journal of Aircraft *are presented in this special department. Entries must be restricted to a maximum of 1000 words, or the equivalent of one* Journal *page including formulas and figures. A discussion will be published as quickly as possible after receipt of the manuscript. Neither the AIAA nor its editors are responsible for the opinions expressed by the correspondents. Authors will be invited to reply promptly.*

Comment on "Equivalence Between Sideslip and Roll in Wind-Tunnel Model Testing"

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IN Ref. 1 the author states "the equivalence between orientations obtained by a combination of pitching-yawing and by a combination of pitching-rolling has not been specifically addressed in the available literature." In actual fact, the relationship between the associated systems is routinely used in wind-tunnel testing, and total angle-of-attack plane aerodynamics has been used for many years to simplify high-alpha aerodynamic formulations.[2,3] The geometrically equivalent roll and sideslip angles given in Fig. 3 of Ref. 1 have previously been published in Ref. 3. Although this topic does not in itself merit further discussion, it does raise an important question: are the high-alpha measurements with the rolled model equivalent to their counterparts in the conventional test setup at corresponding pitch and yaw angles? The answer is, in general, "no."

The relationship between the aerodynamics in the two frames of reference has been invoked to diagnose the facility interference effects influencing dynamic tests of aircraft. In forced oscillation tests of the Standard Dynamics Model,[4] the model was set at fixed pitch angles and banked at the four angles $\phi = \phi + n\pi$, $n = 0, 1$, obtaining the results in Fig. 1. The wing-span to test-section-width ratio was 0.6. The measured aerodynamics were not invariant even though the angles of attack and sideslip were identical in the four orientations.[4,5] The variations observed were attributed to unsteady support and wall interference on the rolling-moment derivatives $C_{lq} + C_{l\dot{\alpha}}$, $C_{l\alpha}$ and coupled support/wall interference on the yawing-moment derivatives $C_{nq} + C_{n\dot{\alpha}}$, $C_{n\alpha}$ (Ref. 5). Fluctuations in the vortex-induced velocity distribution produced by model motion are typically significant for configurations with strong vortex flows.[6] The nature of the unsteady interference is strongly dependent on the test configuration and the installation geometry.[7–9]

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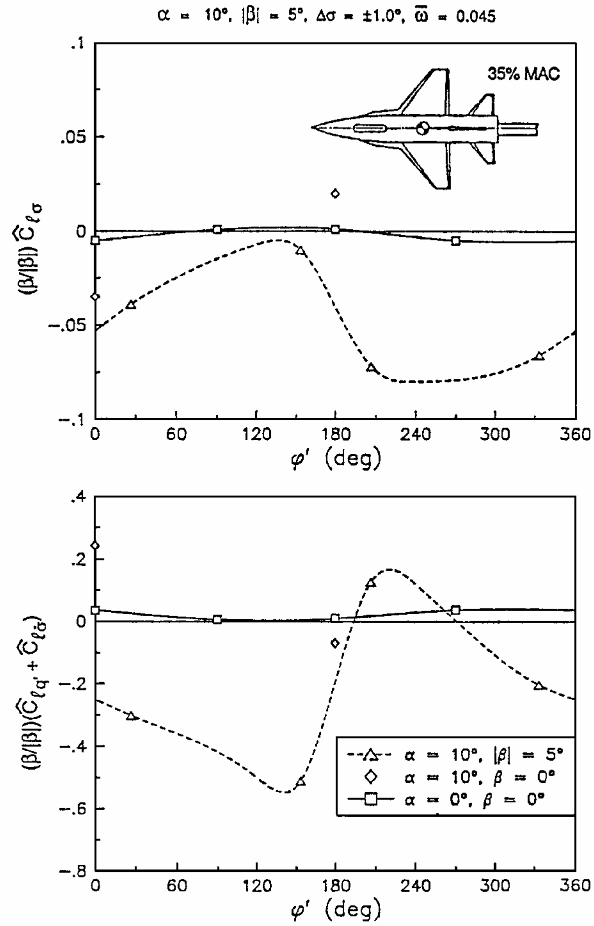

Fig. 1 Effect of model roll orientation on Standard Dynamics Model rolling-moment derivatives[5] at $M_\infty = 0.6$.

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Comment on "Moving-Wall Effect on Unsteady Boundary Layer"

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IN Ref. 1 an elegant analysis is presented which demonstrates theoretically that the moving-wall effect influences the separation of the boundary layer on a stalling airfoil in the manner described in the discussion of Fig. 14 in Ref. 2. That is, the moving-wall effect will amplify the accelerated-flow effect on a pitching airfoil but counteract it on an airfoil describing a plunging motion.[3] It would be of significant interest if the authors were to extend their theoretical analysis to the one-degree-of-freedom three-dimensional flow on a coning body of revolution illustrated by Fig. 6 in Ref. 4. As has been demonstrated analytically,[5] the self-induced coning of a body of revolution[6] is generated by a flow mechanism fundamentally the same as that giving rise to dynamic lift overshoot on an oscillating airfoil. This is important in view of the fundamental role that this flow phenomenon plays on a combat aircraft maneuvering at high angles of attack.[7,8]

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Reply by S. Tavoularis to M. E. Beyers and L. E. Ericsson

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I BECAME aware of Ref. 1[2] of the comment, only after publication of my Note.[3] I also cited it in a subsequent publication.[1] Unfortunately, I was unaware of it while I was rederiving independently the geometrical expressions in my Note and neither were the wind-tunnel professionals that I consulted with nor the *Journal of Aircraft* editor and reviewers. I apologize to the *Journal of Aircraft* readers for the redundancy.

The expressions in Refs. 2 and 3 are purely geometrical and exact and, of course, cannot be expected to apply under conditions of significant interference. Even so, they seem to apply fairly well to steady-flow model tests in a high-speed wind-tunnel facility, as clearly demonstrated in Ref. 1. Moreover, such expressions were never meant to be used in unsteady flows, and I am rather surprised that the authors of the comment feel the need to publish such a statement. In unsteady wind-tunnel testing, like in any unsteady flow configuration, it is not only the facility effects that must be accounted for but the history of flow development as well.

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