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Stability, Flying Qualities and Parameter Estimation of a Twin-Engine CS-23/FAR 23 Certified Light Aircraft

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This paper presents some results of the flight test campaign conducted on the Tecnam P2006T aircraft, on the occasion of its certification process. This twin-engine propeller airplane is certified under the normal category CS-23 and FAR 23. A prototype of this light aircraft has been tested in flight for a post-design performance optimization and for the assessment of flight qualities. These experiences have led to the application of two winglets to the original wing. The final configuration has been extensively tested for the achievement of CS-23 certification. At the same time the airplane model, through a dedicated set of flight maneuvers, has been characterized by means of parameter estimation studies. The longitudinal and lateral-directional response modes have been assessed and quantified. The aircraft stability derivatives have been estimated from the acquired flight data using the identification technique known as Output Error Method (OEM). Some estimated stability derivatives have been also compared with the corresponding values extracted from leveled flight tests and from wind tunnel tests performed on a scaled model of the aircraft.

Nomenclature

a_x, a_y, a_z	=	acceleration of aircraft mass center along the body-fixed x-axis, y-axis, z-axis (m/s^2)
b	=	wing span (m)
c	=	reference chord (mean aerodynamic chord) (m)
C_L, C_D, C_M	=	lift coefficient, drag coefficient, moment coefficient
C_l, C_n, C_Y	=	coefficients of roll moment, yaw moment, side-force
F_s	=	stick control force (N)
f_n	=	natural frequency (Hz)
I_{xx}, I_{yy}, I_{zz}	=	aircraft moments of inertia (kg m^2)
l_{tx}, l_{ty}, l_{tz}	=	coordinates of thrust vector application point in the body-fixed reference frame (m)
M	=	mach number
p, q, r	=	roll, pitch, yaw angular speeds (rad/s)
P_a	=	absolute pressure (N/m^2)
S	=	wing area
T	=	thrust (N) or generic oscillation period (s)
V	=	generic speed (m/s)
V_{TAS}, V_{KIAS}	=	true, calibrated airspeeds (m/s)
x, y, z	=	standard body-fixed reference axes, with origin at the center of gravity
X_{cg}	=	distance of center of gravity from leading edge of mean aerodynamic chord (m)

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