

# Accepted Manuscript

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PII: S1270-9638(16)30338-8  
DOI: <http://dx.doi.org/10.1016/j.ast.2016.11.001>  
Reference: AESCTE 3818

To appear in: *Aerospace Science and Technology*

Received date: 27 July 2016  
Accepted date: 3 November 2016

Please cite this article in press as: N.J. Lawson et al., Jetstream 31 national flying laboratory: Lift and drag measurement and modelling, *Aerosp. Sci. Technol.* (2016), <http://dx.doi.org/10.1016/j.ast.2016.11.001>

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**Jetstream 31 National Flying Laboratory: Lift and Drag Measurement and Modelling**

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**Abstract:**

Lift and drag flight test data is presented from the National Flying Laboratory Centre, Jetstream 31 aircraft. The aircraft has been modified as a flying classroom for completing flight test training courses, for engineering degree accreditation. The straight and level flight test data is compared to data from 10% and 17% scale wind tunnel models, a Reynolds Averaged Navier Stokes steady-state computational fluid dynamics model and an empirical model. Estimated standard errors in the flight test data are  $\pm 2.4\%$  in lift coefficient,  $\pm 2.7\%$  in drag coefficient. The flight test data also shows the aircraft to have a maximum lift to drag ratio of 10.5 at Mach 0.32, a zero lift drag coefficient of 0.0376 and an induced drag correction factor of 0.0607. When comparing the characteristics from the other models, the best overall comparison with the flight test data, in terms of lift coefficient, was with the empirical model. For the drag comparisons, all the models under predicted levels of drag by up to 43% when compared to the flight test data, with the best overall match between the flight test data and the 10% scale wind tunnel model. These discrepancies were attributed to various factors including zero lift drag Reynolds number effects, omission of a propeller system and surface excrescences on the models, as well as surface finish differences.

**Keywords:** Flight test, computational fluid dynamics, wind tunnel aerodynamics, empirical model

**NOMENCLATURE**

A	wing reference area ( $m^2$ )
b	aircraft span (m)
c	mean aerodynamic wing chord (m)
D	aircraft drag (N)
$C_D$	drag coefficient
$C_L$	lift coefficient
$C_P$	power coefficient
$C_Q$	torque coefficient
$C_W$	weight coefficient
$c_f$	skin friction coefficient
d	propeller diameter (m)
g	acceleration due to gravity ( $m/s^2$ )
J	advance ratio
K	induced drag correction factor
l	fuselage length (m)
L/D	Lift to drag ratio
Re	Reynolds number based on wing chord
V	aircraft velocity (m/s)
Q	engine torque (Nm)

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