NWTF

NWTF Experimental Database

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2 April 2025

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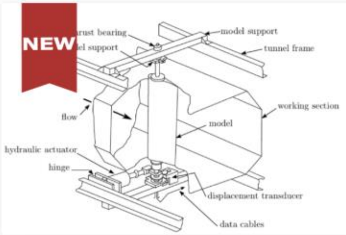
Why an Experimental Database?

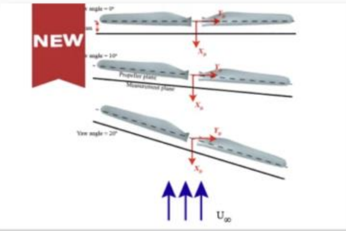
- Typically a grant condition to make experimental data openly available, but…
  - Done poorly with a dump of data and no explanation
  - Or not done at all
- EPSRC Network Grant funding to
  - Create a world leading exemplar for dissemination of aerodynamic data
  - Encourage best practice
  - Ensure expensive, high quality data is exploited
- Combination of a front end on the NWTF web page and the back end data on existing University repositories
- Aim to
  - Be accessible, but provide sufficient details
  - Allow easy access to key data in simple formats
  - Sustainable and not tied to proprietary formats/technology
  - Create impact – want researchers to use your data!

Current Status



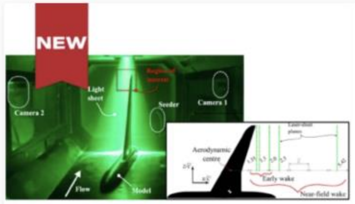
Air Jet Flow Control On Pitching Aerofoil

Facility: Cranfield University
Keyword: aerofoil
Date created / revision: 5 March 2025



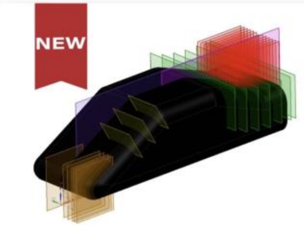
Two-Bladed Propeller Performance in Inclined Flow

Facility: University of Glasgow
Keyword: aerofoil
Date created / revision: 17 December 2024



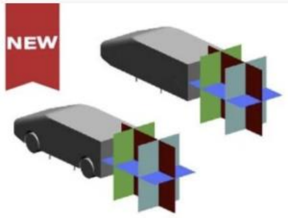
Wingtip Vortex structure in Swept-tapered wings

Facility: University of Glasgow
Keyword: PIV
Date created / revision: 18 December 2024



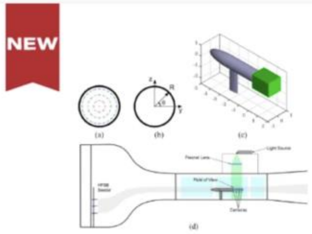
SAE 20 Degree Notchback Automotive Reference Model

Facility: Loughborough University
Keyword: Automotive
Date created / revision: 21 May 2024



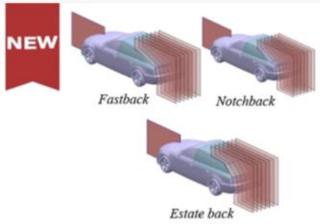
Windsor Automotive Reference Model

Facility: Loughborough University
Keyword: Automotive
Date created / revision: 4 June 2024



Axisymmetric Body

Facility: Loughborough University
Keyword: Automotive
Date created / revision: 17 June 2024



Automotive DrivAer model – Fastback, Notchback, Estate back

Facility: Loughborough University
Keyword: Automotive
Date created / revision: 19 June 2024

+ 2 University and 1 Industry in progress

Example Data Set https://www.nwtf.ac.uk/dataset/1462/

Home → Experimental Database → Wingtip Vortex structure in Swept-tapered wings

Wingtip Vortex structure in Swept-tapered wings

Date/revision:
18 December 2024

Retain original authorship

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Linkedin and email

Introduction:

Induced drag associated with the wing wake remains a critical concern for the aviation industry. In addition the wingtip vortex poses significant challenges for flight safety, especially in crowded airspace near airports, where take-off and landing can be hazardous, particularly at low altitudes. To mitigate these risks, advancements in wing aerodynamics are necessary to reduce wingtip vortex strength, induced drag, and environmental impact. Understanding the near-field dynamics of wingtip vortices is crucial for designing more efficient wingtip devices which can help reduce vortex strength and improve safety."

Simple introduction

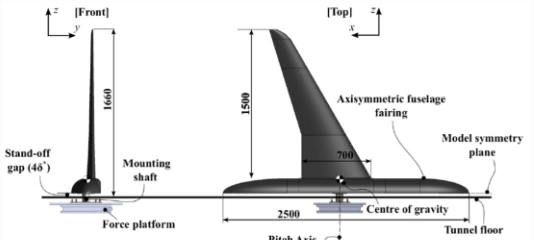
Trailing vortices can persist for great distances downstream before dissipating into the atmosphere. Significant efforts have been made to develop theoretical and numerical models for the roll-up process of trailing wingtip vortices. Most experimental investigations have focused on either tracking the mean velocities of the trailing vortex or validating vortex dynamics numerically. These studies have primarily involved wings of simple rectangular planforms[1], examining the formation and development of tip vortices in the near-field. However, limited information is available on the vortex core's structure due to experimental resolution constraints.

This study investigates the near-field vortex wake characteristics of a planar wing configuration using stereoscopic particle imaging velocimetry (sPIV) at $Re = 1.5 \times 10^6$, based on the wing's mean aerodynamic chord. High-resolution, non-intrusive measurements at 200 Hz were conducted to document wake vortex formation and analyze the evolution of tangential and axial velocity distributions, providing essential validation data for numerical simulations. All results from these measurements can be found in Skinner et al. [2], which offers a detailed description of the test conditions and wind tunnel setup, along with access to the full dataset.

Link to original raw data

Model geometry

Drawings, coordinate systems



Markdown generates: html and standalone pdf

Time averaged drag coefficient

The absolute values of drag, moments, and their corresponding coefficients can be downloaded from here.

Underlying data simple text csv files (on repository)

AoA	C_L	C_D	C_{F_z}	C_{M_x} (Roll)	C_{M_y} (Yaw)	C_{M_z} (Pitch)
-5°	-0.24245	0.02677	-0.02587	-0.47513	-0.01515	-0.02913
-4°	-0.14217	0.02543	-0.02272	-0.27979	-0.00803	-0.05537
-3°	-0.04528	0.02399	-0.02023	-0.08600	-0.00257	-0.08080
-2°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-1°	0.14950	0.02355	-0.01608	0.30183	0.00259	-0.13390
0°	0.25223	0.02453	-0.01620	0.50530	0.00243	-0.16115
1°	0.35451	0.02692	-0.01749	0.70732	0.00070	-0.18728
2°	0.45790	0.03111	-0.01860	0.91025	-0.00251	-0.21349
3°	0.55974	0.03476	-0.01928	1.11236	-0.00760	-0.23886
4°	0.66391	0.03961	-0.02306	1.31378	-0.01477	-0.26228
5°	0.76375	0.04542	-0.02917	1.50464	-0.02365	-0.28291
6°	0.85820	0.05290	-0.03879	1.68243	-0.03343	-0.29885
7°	0.94622	0.06014	-0.04834	1.84659	-0.04440	-0.31229
8°	1.03447	0.06767	-0.06028	2.00671	-0.05736	-0.32364
9°	1.11889	0.07578	-0.07396	2.15570	-0.07115	-0.33226
10°	1.19708	0.08467	-0.08916	2.28968	-0.08513	-0.33628
11°	1.27119	0.09525	-0.10579	2.40758	-0.09880	-0.33654
12°	1.33537	0.10953	-0.12254	2.49827	-0.11137	-0.33156
13°	1.39899	0.12402	-0.14357	2.57619	-0.11979	-0.32265
14°	1.44970	0.14048	-0.16156	2.63182	-0.12634	-0.31094

Important data as text and/or plots

Wind Tunnel Corrections

No corrections have been made to the data.

CAD files

CAD

Planar wing.prt	Planar wing.stp
Planar wing with fuselage.prt	Planar wing with fuselage.stp

Mean flow field

Sometimes code to help process/plot

The MATLAB code for generating the contour plot can be downloaded from this link.

x/c = 1.35	x/c = 1.5	x/c = 2
Coordinates (y.csv, z.csv)	Coordinates (y.csv, z.csv)	Coordinates (y.csv, z.csv)
AOA / Mean velocities (.csv)	AOA / Mean velocities (.csv)	AOA / Mean velocities (.csv)

Data links in tables

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Future Work

- More datasets – although we do most of the work we do need your help!
- Formal definition of best practice, example templates
- File formats: current simple csv do not work so well for larger data sets (e.g. PIV, time resolved)
- Interactivity: can we interactively plot the data?
  (e.g. https://autocfd4.cfdsolutions.net)
- Better tracking of utilisation – cannot determine real downloads because of AI crawler bots