



ESDU 00001

Issued January 2000

Issue 27 April 2016

Aerodynamics Series: Record of Documents

ESDU Copyright material. For current status contact ESDU.

AERODYNAMICS SERIES: RECORD OF DOCUMENTS

CONTENTS

	Page
1. PREFACE TO AERODYNAMICS SERIES	1
2. SECTIONS FOR AERODYNAMICS SERIES	2
3. LOCATION SCHEDULE FOR DATA ITEMS IN AERODYNAMICS SERIES	4
4. AMENDMENT RECORD FOR AERODYNAMICS SERIES	7
5. AERODYNAMICS SOFTWARE RECORD	39

ESDU Copyright material. For current status contact ESDU.

AERODYNAMICS SERIES: RECORD OF DOCUMENTS

1. PREFACE TO AERODYNAMICS SERIES

ESDU Data Items provide validated information in engineering design and analysis for use by, or under the supervision of, qualified engineers. The data are founded on an evaluation of all the relevant information, both published and unpublished, and are invariably supported by original work of ESDU staff engineers or consultants. The whole process is subject to independent review for which crucial support is provided by industrial companies, government research laboratories, universities and others from around the world through the participation of some of their leading experts on ESDU Technical Committees. This process ensures that the results of much valuable work (theoretical, experimental and operational), which may not be widely available or in a readily usable form, can be communicated concisely and accurately to the engineering community.

ESDU Data Items are organised in Series. The Series on aerodynamics is prepared under the guidance of the Aerodynamics Committee which has the following constitution:

Chairman

Mr A.J. Wells — Independent

Vice-Chairman

Mr P.D. Chappell — Independent

Members

Mr H. Åslund* — Saab Aeronautics, Sweden

Mr K. Bradbrook — Independent

Mr P. Camacho* — Boeing, Long Beach, CA, USA

Dr P.C. Dexter — Independent

Mr J.R.J. Dovey — Independent

Prof. K.P. Garry — Cranfield University

Prof. J.M.R. Graham — Imperial College, London

Mr M.J. Green — Independent

Mr J.M. van den Heever* — Denel Dynamics, South Africa

Dr G.A. Johnson — BAE SYSTEMS, Advanced Technology Centre, Filton, Bristol

Dr E.H. Kitchen — Rolls-Royce Commercial Aero Engines Ltd, Derby

Mr C.S. Lee — BAE SYSTEMS, Warton

Mr J.-B. Leterrier* — Airbus, Toulouse, France

Miss M. Maina — Aircraft Research Association Ltd

Mr R.S.F. de Mello* — Embraer, Brazil

Mr A. Miller — Independent

Mr S. Morris — Airbus UK, Filton, Bristol

Mr J. Tweedie — Short Brothers plc, Belfast

Dr M. West — BAE SYSTEMS, Prestwick

* Corresponding Member

Technical Staff

Mr A.J. Clarke — Head of Aerodynamics Group

Mr S.F. Wood — Principal Engineer, Aerodynamics Group

Mr C.J. Batt — Senior Engineer, Aerodynamics Group

Users of the ESDU service are encouraged to regard ESDU as a widely based group of people constantly available to answer questions and discuss the application of data in engineering.

2. SECTIONS FOR AERODYNAMICS SERIES

Section

ORGANISATION

1. Organisation Documents

PROPERTIES OF GASES AND SHOCK WAVES

2. Properties of Gases
3. Isentropic Flow and Shock Waves

ATMOSPHERIC PROPERTIES

4. Properties of the Atmosphere
5. Atmospheric Turbulence
6. Wind Speeds

AEROFOILS AND WINGS

7. Aerofoils and Wings – General
8. Aerofoils at Subcritical Speeds – Pressure Distribution, Lift, Pitching Moment, Aerodynamic Centre
9. Aerofoils at Subcritical Speeds – Drag
10. Aerofoils at Supersonic Speeds – Pressure Distribution, Lift, Pitching Moment, Drag
11. Critical Mach Number and Pressure Coefficient
12. Flat Plates – Boundary Layers, Skin Friction and Surface Roughness
13. Wings – Lift, Pitching Moment, Aerodynamic Centre, Spanwise Loading
14. Wings – Drag

BODIES

15. Bodies – General
16. Bodies – Drag
17. Bodies – Pressure Distribution, Normal Force, Pitching Moment, Centre Of Pressure

WING BODY COMBINATIONS

18. Wing-Body Combinations – Lift, Normal Force, Pitching Moment, Aerodynamic Centre, Upwash
19. Wing-Body Combinations – Drag

CONTROLS AND FLAPS

20. Controls – Lift, Pitching Moment, Rolling Moment, Drag
21. Controls – Hinge Moment
22. Flaps – General
23. Flaps – Lift: Aerofoils
24. Flaps – Lift: Wings
25. Flaps – Lift Curve
26. Flaps – Pitching Moment
27. Flaps – Drag

EXCRESCENCE/CAVITY/UNDERCARRIAGE/CANOPY DRAG

28. Excrescence Drag
29. Cavity Drag
30. Undercarriage Drag
31. Canopy Drag

CAVITY AERODYNAMICS

- 32. Cavity Aerodynamics and Aero-Acoustics
- 33. Cavity Adverse Unsteady Flow Alleviation

INTERNAL FLOW

- 34. Internal Flow Systems – Ducts
- 35. Internal Flow Systems – Nacelles, Intakes and Nozzles

POWERPLANT/AIRFRAME INTERACTIONS

- 36. Powerplant/Airframe Interactions – Propeller Powered Aircraft
- 37. Powerplant/Airframe Interactions – Jet Powered Aircraft

AIRCRAFT STABILITY

- 38. Stability of Aircraft – General
- 39. Stability of Aircraft – Longitudinal Stability – Ground Effect, Downwash, Tandem Surfaces, Tailplanes
- 40. Stability of Aircraft – Longitudinal Stability – Derivatives due to Rate Of Pitch
- 41. Stability of Aircraft – Pitch-Break Characteristics
- 42. Stability of Aircraft – Lateral Stability – Derivatives due to Sideslip
- 43. Stability of Aircraft – Lateral Stability – Derivatives due to Rate of Roll
- 44. Stability of Aircraft – Lateral Stability – Derivatives due to Rate of Yaw

UNSTEADY AERODYNAMICS

- 45. Unsteady Aerodynamics

PARACHUTE AERODYNAMICS

- 46. Parachute Aerodynamics

BLUFF BODIES

- 47. Bluff bodies and Structures – Mean Forces
- 48. Bluff bodies and Structures – Fluctuating Forces and Response

AERODYNAMIC HEATING

- 49. Aerodynamic Heating and Heat Transfer

WIND-TUNNEL CORRECTIONS

- 50. Wind-Tunnel Corrections

3. LOCATION SCHEDULE FOR DATA ITEMS IN AERODYNAMICS SERIES

Item No.	Section	Item No.	Section
00.01.06	2	Controls 01.01.01	42
00.01.07	2	01.01.03	20
00.01.08	2	01.01.04	20
00.01.09	2	04.01.00	21
00.01.11	2	04.01.01	21
00.01.12	2	04.01.02	21
00.02.05	12	04.01.03	21
00.03.05	3	04.01.04	21
00.03.26	49	04.01.06	21
00.03.28	3	04.01.08	21
00.03.30	3	08.01.01	20
00.03.31	3		
A1	1	Flaps 01.01.08	24
A2	1	01.01.09	24
		02.01.06	27
S.00.01.10	34	02.01.07	27
S.00.03.06	3	02.01.08*	27
S.00.03.07	34	05.01.01	23
S.00.03.08	3	08.01.01	26
S.00.03.09	3	08.01.02	26
S.00.03.13	3		
S.00.03.14	3	Wings 00.03.01	11
S.00.03.15	3	01.01.01	13
S.00.03.16	3	01.01.04	13
S.00.03.22	3	01.01.05	8
S.00.03.23	3	01.01.07	8
S.00.03.27	2	02.04.00	9
		02.04.01	9
Aircraft 02.03.02	19	02.04.02	9
06.01.00	38	02.04.03	9
06.01.01	43	02.04.09	9
06.01.03	42	02.04.11	9
06.01.09	42	05.01.01	39
07.01.00	38		
08.01.05	8	S.00.03.03	10
08.01.09	35	S.00.03.04	10
		S.00.03.05	10
S.01.03.02	42	S.00.03.18	49
S.02.03.01	19	S.02.03.02	14
S.06.03.01	43	S.02.03.07	10
S.06.03.02	43	S.02.03.09	14
S.06.03.03	43	S.02.03.10	10
S.06.03.04	42	S.02.04.12	10
		S.02.04.13	10
Bodies S.02.03.01	16	S.05.03.01	10
S.02.03.02	16	S.08.03.02	40
S.02.03.08	16		
S.02.03.12	16		
S.05.03.01	17		

* A program is associated with this Item.

Text in red denotes a change from the previous issue

Item No.	Section	Item No.	Section	Item No.	Section	Item No.	Section
66028	35	76033	16	84020	45	92007	42
66031	14	* 77012	18	84026	8	92024	18
66032	14	77020	16	84035	28	92029	42
66034	8	77021	4	85006	43	92031	24
67011	9	77028	15	* 85010	43	92039	28
67035	35	77032	48	85015	36	92043	18
67041	31	78008	4	85017	36	93007	42
68019	12	* 78013	18	85020	5	* 93015	13
68020	12	78017	4	86002	35	93019	24
68021	16	* 78019	16	86010	5	93032	28
69009	49	78037	15	86017	36	93034	13
69010	49	78041	16	* 86021	38	94026	23
69011	49	79006	42	86041	38	94027	23
69012	49	79015	30	* 87001	13	94028	23
70008	3	79020	15	* 87005	27	94029	23
70009	3	79022	16	* 87008	20	94030	23
70010	3	79025	48	87012	45	94031	23
* 70011	13	79026	47	* 87024	27	* 94037	14
* 70012	13	80003	47	* 87031	13	* 94038	14
70015	13	80006	16	* 87033	17	95009	18
71006	13	* 80020	39	87035	48	* 95010	13
71007	13	80021	16	88003	21	95021	24
71012	47	80024	50	* 88013	20	95022	13
71016	47	80025	47	* 88029	20	95025	14
71017	44	80033	42	88030	13	96003	25
71018	28	80034	42	88031	36	96012	16
71020	8	80037	35	* 88040	20	* 96025	14
72021	44	81004	34	* 89008	17	* 96026	20
72023	39	81013	42	89009	21	96032	24
72024	8	* 81014	43	89010	21	96033	16
73006	42	81017	47	* 89014	17	97002	22
73016	12	* 81023	39	* 89029	39	97003	22
73017	4	* 81024	35	* 89034	13	97009	24
74008	11	81032	42	* 89042	18	97011	24
74009	24	81034	45	* 89047	36	97020	8
74010	27	82005	45	* 90005	45	* 97021	39
74011	20	82010	42	* 90010	40	97022	16
74012	20	82011	42	90013	13	98009	26
74030	5	82017	44	* 90020	18	98011	8
* 74035	14	82018	17	90029	28	98017	26
74036	29	82020	45	90030	20	* 99003	8
75004	14	82026	6	* 90034	17	99004	26
75005	35	82028	16	91004	40	99010	16
75027	11	82034	37	91007	18	99014	26
75028	28	83006	43	* 91009	39	* 99031	25
75031	28	* 83010	45	91014	24	00001	1
76003	7	83025	28	* 91028	28	00006	29
76008	28	83026	44	91029	28	00007	29
* 76015	18	83040	13	91031	42	00009	1
76026	20	83045	6	91042	18	00017	16
76028	50	84002	44	92002	20	* 00025	42

* A program is associated with this Item.

Text in red denotes a change from the previous issue

ESDU Copyright material. For current status contact ESDU.

Item No.	Section	Item No.	Section	Item No.	Section	Item No.	Section
00026	16						
00027	9						
00028	17						
00029	26						
01005	41						
* 01007	27						
01012	16						
01013	26						
02008	32						
02012	16						
03006	35						
03017	26						
04007	17						
04013	1						
04014	1						
04023	32						
05015	17						
06001	9						
06012	36						
06013	36						
06014	27						
06020	7						
07002	14						
07003	14						
07005	17						
08011	33						
08012	33						
08013	27						
09012	46						
10016	29						
10017	9						
10022	14						
* 10023	7						
13005	38						
* 13009	18						
13009							
13009							
14004	20						
14005	20						
TM 4	7						
TM49	42						
TM 168	7						
TM 169	13						
TM 172	20						
TM 178	42						

* A program is associated with this Item.

4. AMENDMENT RECORD FOR AERODYNAMICS SERIES

Latest Supplement Issue No. 192, April 2016 (Web Build: 2016-04)

Contents of Supplement

New and Amended Data Items and Technical Memoranda

In Section 1 (Organisational Documents)

00001 **Aerodynamics Series: Record of Documents**
Issue 27, April 2016.

In Section 8: Aerofoils at Subcritical Speeds - Pressure Distribution, Lift, Pitching Moment, Aerodynamic Centre

99003 **Generation of GUNACA 23-series of low-drag aerofoils**
Amendment A Removal of program a9903v10, which is not compatible with 64-bit
December 2015 Windows operating systems. (Program b9903v10 is retained however.)
Editorial alterations to Data Item, including removal of text relating to
program a9903v10.
Some rearrangement of contents of Data Item.

In Section 20: Controls – Lift, Pitching Moment, Rolling Moment, Drag

C.08.01.01 **Rate of change of pitching moment coefficient with control**
Amendment B **deflection for a plain control in incompressible two-dimensional**
August 2015 **flow, m_0**
Addition of new computer program ESDUpac ac811v10.
Editorial alterations to Data Item, including restructuring and new advice on
the applicability of the method.

In Section 36: Powerplant/Airframe Interactions - Propeller Powered Aircraft

88031 **Lift and longitudinal forces on propeller/nacelle/wing/flap systems**
Amendment E Addition of new computer program ESDUpac a8831v10.
December 2015 Editorial alterations to Data Item. Inclusion of new Example for a flaps-up
case. Corrections to values given in Example 2.

In Section 39: Stability of Aircraft - Longitudinal Stability - Ground Effect, Downwash, Tandem Lifting Surfaces, Tailplane

72023 **Low-speed longitudinal aerodynamic characteristics of aircraft in**
Amendment A **ground effect**
March 2015 Addition of new computer program ESDUpac a7223v10.
Editorial alterations to Data Item, including addition of clarifying text and
some re-arrangement of text.

Text in red denotes a change from the previous issue

89029 **Installed tailplane lift-curve slope at subsonic speeds**
Amendment B Editorial alterations to Data Item, including addition to Section 4.2 of further
August 2015 advice on Accuracy.

New and Amended Software

ESDUpac A7223	Version 1.0 (NEW)	March 2015
ESDUpac A8831	Version 1.0 (NEW)	December 2015
ESDUpac AC811	Version 1.0 (NEW)	August 2015

ESDU Copyright material. For current status contact ESDU.

Text in red denotes a change from the previous issue

List of Amendments

So that the user may at any time check where previous amendments to the Series have been made, the following is a complete list of those changes. Further details relating to the changes made may always be obtained from ESDU.

Some page references refer to Items current at the time and will obviously not conform to the latest version of an Item. However, the gist of the amendment remains clear in most cases.

Item	Change	Dated
00.00.00	Withdrawn	May 1976
00.01.01	Withdrawn Superseded by 78017.	July 1978
00.01.02		
00.01.03	Withdrawn Superseded by 77021.	Oct. 1977
00.01.04		
00.01.05	Withdrawn Superseded by 78008.	Jan. 1978
00.01.06	Amend. A Replaced by reprint.	May 1982
00.01.07	Amend. A Replaced by reprint.	July 1972
00.01.08	Amend. A Replaced by reprint.	May 1982
00.01.09	Amend. A Replaced by reprint.	Apr. 1975
00.01.11	Amend. A Replaced by reprint.	May 1982
00.01.12	Amend. A Replaced by reprint.	May 1982
00.02.01	Withdrawn Superseded by 73017.	Aug. 1973
00.02.02		
00.02.05	Amend. A Replaced by reprint.	Feb. 1981
00.02.07	Withdrawn Superseded by 67040.	Nov. 1967
00.02.08		
00.02.09	Withdrawn Superseded by 77008.	May 1977
00.02.10	Withdrawn Superseded by 67040.	Nov. 1967
00.03.00	Withdrawn	May 1988
00.03.01	Withdrawn Superseded by 74008.	Apr. 1974
00.03.02		
00.03.03	Withdrawn	Feb. 1948
00.03.04	Withdrawn Superseded by 73017.	Aug. 1973
00.03.05	Replaced by reprint.	July 1971
00.03.24	Withdrawn Superseded by 74029.	Oct. 1974
00.03.26	Amend. A Replaced by reprint.	Apr. 1973
00.03.28	Amend. A Replaced by reprint.	Feb. 1978
00.03.30	Amend. A Replaced by reprint. (Figure 1 misprinted in some earlier versions.)	Jan. 1999
00.03.29	Withdrawn Superseded by 72011.	June 1972
02.00.01	Withdrawn Superseded by 72009.	June 1972
02.00.02	Withdrawn Superseded by 72010.	June 1972
A.00.00.02		
A.00.00.03	Withdrawn Superseded by 86021.	Oct. 1986
A.00.00.04		

Item		Change	Dated
A.00.00.05	Withdrawn	Superseded by 86041.	Dec. 1986
A.00.00.06			
A.01.01.01	Withdrawn	Superseded by 72023.	Oct. 1972
A.02.03.02	Amend. A	Replaced by reprint.	Dec. 1982
A.06.01.00	Amend. I	Replaced by reprint.	Oct. 1986
	Amend. J	This summary Data Item has been corrected, updated, and altered in layout.	May 2013
	Amend. K	Editorial changes to Notation of stability derivatives parameters, which are now defined as unit-less.	Jan. 2015
A.06.01.01	Amend. A	Replaced by reprint.	Mar. 1981
A.06.01.02	Withdrawn	Superseded by 72021.	Sept. 1972
A.06.01.03	Amend. B	Replaced by reprint.	Apr. 1973
A.06.01.04	Withdrawn	Superseded by 80033.	Dec. 1980
A.06.01.05	Withdrawn	Superseded by 73006.	June 1983
A.06.01.06	Withdrawn	Superseded by 70006.	June 1970
A.06.01.07	Withdrawn		Aug. 1973
A.06.01.08	Withdrawn	Superseded by 72021.	Sept. 1974
A.06.01.09	Amend. A	Replaced by reprint incorporating A.06.01.10 and 11.	July 1979
	Amend. B	Pages 1 and 2 replaced by reprints to delete reference to C.06.01.01 on page 2.	Aug. 1988
A.07.01.00	Amend. G	Replaced by reprint.	Oct. 1986
	Amend. H	This summary Data Item has been corrected, updated, and altered in layout.	May 2013
	Amend. I	Editorial changes to Notation of stability derivatives parameters, which are now defined as unit-less	Jan. 2015
A.07.01.01	Withdrawn	Superseded by 79006.	June 1979
A.07.01.02	Withdrawn	Superseded by 71017.	Sept. 1971
A.08.01.01	Withdrawn	Superseded by 76015.	Sept. 1976
A.08.01.02			
A.08.01.03	Withdrawn	Superseded by 80020.	Oct. 1980
A.08.01.04			
A.08.01.05	Amend. A.	Replaced by reprint.	Apr. 1973
	Amend. B	A second Derivation (2) has been added after consulting work file archive.	Jan. 2007
A.08.01.07	Withdrawn	Superseded by 89042.	Nov. 1989
A.08.01.09	Amend. A	Replaced by reprint.	Feb. 1981
A.S.01.03.01	Withdrawn	Superseded by 91007.	July 1991