

Catalogue of the papers and correspondence of

**ARTHUR RODERICK COLLAR FRS**

(1908 - 1986)

Compiled by Peter Harper and Timothy E. Powell

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## GENERAL INTRODUCTION

## PROVENANCE

The papers were received from Professor Alan Simpson, Collar's colleague in the Department of Aeronautical Engineering at Bristol University, and Mr M J Collar, elder son, in March and May 1988, respectively.

## OUTLINE OF THE CAREER OF A R COLLAR

Arthur Roderick Collar was born in West Ealing on 22 February 1908. He was educated at the Simon Langton School in Canterbury, before winning a scholarship to Emmanuel College Cambridge in 1926 to read for the Mathematics and Natural Sciences Triposes.

He graduated in 1929, joining the Aerodynamics Department at the National Physical Laboratory, Teddington. Here Collar worked on propellers, airship dynamics, wind-tunnel design, and particularly on flutter and matrix analysis. His book, Elementary Matrices, written in 1938 with colleagues R A Frazer and W J Duncan, soon became a standard work in this field. From 1936 Collar was also involved with the work of the Aeronautical Research Committee (later Council). He served in various capacities with the Council and its subcommittees until its abolition in 1980, holding the Chairmanship 1964-68. During the war Collar headed research work on aeroelasticity at the Royal Aircraft Establishment, Farnborough.

In 1946, partly through his pre-war work for the Aeronautical Research Committee, Collar was offered the newly established Sir George White Chair of Aeronautical Engineering at Bristol University. In addition to his duties as Professor, he served as Dean of the Engineering Faculty 1954-57, and in 1968-69 temporarily as Vice-Chancellor. An honorary Doctorate of Laws was conferred upon him in 1969 and upon retirement in 1973 Collar was appointed Professor Emeritus.

Among many other distinctions gained, Collar was made a Fellow of the Royal Aeronautical Society in 1944, serving as President 1963-64. He was awarded the Society's Gold Medal in 1966 and Hodgkin Prize in 1979. Collar was honoured with the CBE in 1964 and elected to the Fellowship of the Royal Society a year later.

For a full account of the life and work of Collar see R E D Bishop, 'Arthur Roderick Collar 1908-1986', Biographical Memoirs of Fellows of the Royal Society, 33, 1987.

#### DESCRIPTION OF THE COLLECTION

The presentation of the material follows the sequence given in the List of Contents. In this small collection Collar's lectures and, to a lesser extent, his Aeronautical Research Committee (later Council) papers predominate.

Section A (Biographical) is very slight but includes notes on his professional career sent to the Minister of Technology in 1967 (A.2) and a copy of R E D Bishop's Royal Society memoir (A.5).

Section B (Aeronautical Research Council) presents a sequence of research papers and papers dealing with matters of internal organisation covering the period 1935-80; of some interest are items B.13 - B.15 which relate to the 1958 Munich air disaster. Also included in this section are a number of research papers prepared while Collar worked for the Royal Aircraft Establishment during the war. It should be noted that a great part of Collar's Aeronautical Research Council papers were destroyed at his own request after his death.



Section C (Lectures, Broadcasts and Publications) is the most substantial of the collection. There are lectures on aeronautics and matrices and lectures to a wide variety of audiences on more general scientific topics, such as engineering education and science and society. In his later years Collar gave talks on humorous poetry, of which he was both very fond and extremely knowledgeable. A few sets of ms notes for these talks can be found at C.45.

Section D (Scientific Correspondence) is again slight, but what survives serves chiefly to illustrate Collar's interest in matrices, a field in which he was an acknowledged authority.

#### ACKNOWLEDGEMENTS

We are very grateful to Professor Simpson and Mr Collar for making the material available, and for their advice and encouragement.

P Harper  
T E Powell  
Bath 1988

SECTION A      BIOGRAPHICAL

- A.1            Certificate of election as a Fellow of the Royal Society,  
18 March 1965.
- A.2            Notes on the Professional Career of Collar.    2pp typescript  
and 4pp list of publications dated November 1966. With ms  
additions and note "as sent to Minister of Technology  
22 iii 67".
- A.3            Interview given to Nonesuch, the Bristol University student  
newspaper, 22 November 1968.
- In his capacity as Vice-Chancellor, Collar discusses the  
issue of student participation in university administration  
in the light of student discontent.
- A.4            Certificate of election as an Honorary Fellow of the Royal  
Aeronautical Society, 25 October 1973.
- A.5            'Arthur Roderick Collar 1908-1986' by R E D Bishop,  
Biographical Memoirs of Fellows of the Royal Society, 33,  
1987.
- A.6            Collar Family Tree.    1p ms (photocopy).

SECTION B      AERONAUTICAL RESEARCH COUNCIL (ARC)      1935 - 1980

Collar's association with the Aeronautical Research Committee (later Council) dates from 1936, when he became Secretary of the Oscillation Subcommittee; he was appointed Assistant Secretary of the ARC 1939-40. Collar's acceptance of the Sir George White Chair in Aeronautics at Bristol University in 1946 took him out of the scientific civil service and he was therefore able to sit on the reconstituted ARC as an Independent (as opposed to Official) Member. Collar was the first person to chair all three of its standing committees (Materials and Structures, Aerodynamics and Propulsion) and served as ARC Chairman 1964-68. His membership of various committees and subcommittees of the ARC continued until its abolition in 1980.

The material consists of a chronological sequence of duplicated typescript papers prepared by Collar for the ARC and its committees and subcommittees, together with a number of notes and reports he wrote while working at the Royal Aircraft Establishment (RAE), Farnborough, during the course of his wartime work on aeroelasticity. Collar's association with the investigations into the Munich air disaster of 1958 is represented by B.13 - B.15. See B.22 for a photocopy of the 1909 interim report of the Advisory Committee for Aeronautics (the predecessor of the ARC) which Collar kept with his ARC papers.



Aeronautical Research Council

- B.1           ARC Stability and Control Subcommittee, 'Note on the Use of a Dead-Centre Control as a Safety Device', 20 November 1935.   2pp.
- ARC Aerodynamics Subcommittee, 'The Performance of the "Hurricane" and "Spitfire" Aeroplanes', 24 June 1940. 7pp and 1p fig.
- B.2           RAE Technical Note, 'Interim note on Typhoon elevator flutter', August 1943. 10pp and 3pp figs.
- RAE Technical Note, 'Virtual Inertia and Control Surface Flutter', February 1944.   3pp.
- B.3           ARC Oscillation Subcommittee, 'Mass Balancing of Controls and Flutter Prevention Devices', 29 July 1944.   5pp.
- ARC Oscillation Subcommittee, 'Note on the Computation of the Sub-Dominant Latent Roots of a Matrix', 28 September 1944. 5pp.
- B.4           RAE Technical Note, 'A proposal for a control system operated by an aerodynamic servo and avoiding large mass-balance weights', December 1944.   5pp.   2 copies, the second with ms note "SRI has been asked for authority to put job out to Lockheed's".
- B.5           RAE Report, 'Mass-balance for spring tab flutter prevention' (with G D Sharpe), October 1945.   19pp and 1p ms table showing the effectiveness of mass-balancing for various aircraft.
- B.6           ARC Stability and Control Subcommittee, 'Some Problems in the Design of Sweptback Wings', 1 January 1946.   4pp.
- B.7           RAE Report, 'An Elaboration of the Criterion for Wing Torsional Stiffness' (with E G Broadbent and Elizabeth B Puttick), with an appendix on 'The Effect of Taper on Wing Flexure-Torsion Flutter Speeds' by E G Broadbent and Elizabeth B Puttick, January 1946.   28pp and 8pp figs.

Aeronautical Research Council

- B.8 British Intelligence Objectives Subcommittee reports, 'German Aircraft Industry - Aeroelasticity' (with H A Jahn, A Robinson and E G Broadbent). Received 30 May 1946. 29pp.
- B.9 Paper 'On the Solution of a Particular Set of Linear Algebraic Equations'. Stamped "Aeronautical Research Council". Received 8 October 1949. 8pp.
- B.10 ARC Oscillation Subcommittee, 'Note on Irreversible Controls', 10 November 1953. 3pp.
- B.11 ARC Oscillation Subcommittee, 'Note on the Development of Stiffness Criteria', 28 November 1953. 5pp. With related correspondence.
- B.12 ARC, 'On the Effect of Wing Bending on the Acceleration due to Landing Impact', June 1954. 5pp and 1p figs.
- B.13 ARC, 'On the Drag Due to Slush', 9 January 1961. 14pp and 2pp figs.
- This report considers the effect of slush on the tricycle undercarriage in impeding the normal take-off of aircraft. This was the principal cause of the crash of the BEA Elizabethan aircraft on 6 February 1958 in which eight members of the Manchester United football team were killed. Items B.14 and B.15 below are Collar's copies of the reports of the subsequent inquiries.
- B.14 'Report by the Federal Republic of Germany relating to the Inquiry into the Accident to G-ALZU AS 57 Ambassador (Elizabethan) on 6th February 1958 at Munich - Riem Airport', 1959, repr. 1965.

Aeronautical Research Council

- B.15 'Report of the German Federal Office of Aviation relating to the re-opened Inquiry into the Accident to BEA Ambassador (Elizabethan) Aircraft G-ALZU on 6th February 1958 at Munich Riem Airport and RAE memorandum on "Application of the Results of Slush Drag Tests on the Ambassador to the Accident at Munich" submitted as evidence to the Inquiry', 1967.
- B.16 ARC Constitution Panel, 'A possible new A.R.C. structure', 19 April 1967. 3pp.
- ARC Constitution Panel report on ARC committee structure, 26 April 1967. 5pp and 3pp figs.
- B.17 ARC, 'A note on the possible utilization of very long-range aircraft', c.1970 (ARC No.30151). 3pp.
- ARC Civil Aircraft Research Committee, 'Long-term civil aircraft requirements: a note on the volume of air traffic in A.D.2000'. Received 5 January 1972. 5pp and 2pp figs. With 1p ms continuation.
- Both items were attached to C.44.
- B.18 ARC, 'Note on a Systems Committee', 11 April 1975. 3pp.
- ARC, 'The ARC and Flight Systems', 31 October 1975. 2pp and 2pp figs.
- ARC, Flight Systems Committee, 'The Genesis of the Flight Systems Committee of the Aeronautical Research Council', 29 June 1976. 2pp.
- B.19 ARC Working Party on Committee Structure, 'A Further Note on ARC Committee Structure', 21 November 1976. 2pp.
- B.20 ARC Aerodynamics Committee, 'A Note on Trailing Vortices', March 1977. 4pp.

Aeronautical Research Council

- B.21           ARC, 13th and Final Report of the Airframe Materials and Structures Committee, April 1980.   7pp.

In its first year in office the newly elected Conservative government abolished numerous 'quangos', among them the ARC and its committees. As a prologue to this report Collar laments the dissolution of the Council in verse.

- B.22           Advisory Committee for Aeronautics, Interim Report, 1909. 5pp and 1p list of committee members (photocopy).



SECTION C      LECTURES, BROADCASTS, PUBLICATIONS

C. 1-C.45      LECTURES

C. 1-C.25      Aeronautics

C.26           Matrix Algebra

C.27-C.44      General Scientific Topics

C.45           Literary Topics

C.46,C.47      BROADCASTS

C.48,C.49      PUBLICATIONS

Lectures, broadcasts, publications

LECTURES

Aeronautics

A chronological sequence of drafts and notes for lectures on aeronautics delivered between 1947 and 1977.

- C.1 'Some Aspects of Stability and Control', Bristol Branch, Royal Aeronautical Society, 4 March 1947. 13pp typescript draft and lp list of slides.
- C.2 'Stiffness and Strength', Bristol University Engineering Society, 17 March 1947. 12pp typescript draft.
- C.3 'The Effects of Distortion on Stability and Control', College of Aeronautics, 14 January 1948. 13pp typescript draft and lp list of slides.
- C.4 'Stiffness and Strength', Brough Branch, Royal Aeronautical Society, 16 November 1949. 13pp typescript draft.
- C.5 'Some Speculations on the Aeroelastic Problems of Rotary Wing Systems', Helicopter Association of Great Britain and the Royal Aeronautical Society, 26 November 1949. 25pp typescript draft with ms corrections.
- C.6 'The Influence of Aeronautics on History', Social and Economic History students, University of Bristol. Part 1, 7 February 1950; part 2, 21 February 1950. 7pp typescript notes with ms additions.
- C.7 'Aeronautics', 10 March 1950. 2pp typescript notes and lp ms notes.
- C.8 'The Influence of Aeronautics on History', Ottawa Aeronautical Society, 13 September 1950. 8pp typescript notes with ms additions.

Lectures, broadcasts, publications

- C.9 'Aeronautics - Larger and Faster', Bristol Science Club, c.1950. 1p typescript notes with ms notes of audience and approximate date, and 1p typescript list of slides.
- C.10 'After Farnborough, what?', [Bristol ?] University Air Squadron, 30 October 1952. 2pp typescript notes.
- C.11 'Aeroelasticity', Manchester University, 13 March 1953, 18pp typescript draft and 1p typescript summary.
- C.12 'Flutter', Preston Branch, Royal Aeronautical Society, 7 October 1953. 13pp typescript draft and 3pp ms notes.
- C.13 'Barriers in Flight', Colston's School Science Society, 27 October 1956. 7pp ms notes.
- C.14 'Aeroelasticity', RAF course, c. 1961. 2pp ms notes with later ms note of audience and approximate date.
- C.15 'Some physical problems posed by hypersonic gas speeds', c.1961. 6pp ms notes with later ms note of approximate date.
- C.16 'The compressibility phenomena arising from increase of aircraft speed'. 15pp ms draft with later note 'Date and purpose not known prob. RAF course circa 1961'.
- C.17 'Trouble crossing the Severn', Institute of Physics and the Physical Society, Swansea, 7 July 1962, 1p ms notes and 1p list of slides.
- Seven over the Severn, Aluminium Wire and Cable Co.Ltd. (1960). 8pp brochure on the construction of seven conductors to carry electricity across the rivers Wye and Severn. Found with the preceding.

Lectures, broadcasts, publications

- C.18 'Industrial aerodynamics', Clifton College, 10 October 1964.  
lp ms notes.
- C.19 'Research in the University of Bristol', Royal Aeronautical Society, 17 February 1965. 6pp ms notes.
- C.20 Lecture on the use of models and wind tunnels, 4 March 1965.  
lp ms notes headed "architects. 4 iii 65".
- 'The Use of Wind Tunnels in the Study of Problems in Industrial Aerodynamics', Royal Aeronautical Society, 1 December 1965. 9pp typescript and lp ms list of slides and lp fig with ms corrections.
- 'The Use of Wind Tunnels in the Study of Industrial Aerodynamic Problems', 1966. 16pp ms draft and lp refs headed 'Basis of Lecture to architects, March 1966' with later note 'Original of R.Ae.Soc.'
- C.21 'Aeronautics Down to Earth', The Kingsford-Smith Memorial Lecture, Sydney, 21 August 1968. 9pp typescript draft.
- 'Down-to-Earth Aerodynamics', Southern Africa Division, Royal Aeronautical Society, Johannesburg, 5 September 1968. 9pp typescript draft.
- 'Aeronautics Down to Earth', 17pp ms draft for the preceding.
- C.22 'Aeronautical Research', first stage students, University of Bristol, 5 March 1970. lp ms notes.
- C.23 'Industrial Aerodynamics', Presidential address, Bristol Association of Engineers, 14 October 1975. 8pp ms notes.



Lectures, broadcasts, publications

- C.24            'Aeroelasticity', first stage students, Aeronautics Department, University of Bristol, 22 January 1976. 6pp ms notes.
- 'Aeroelasticity', first stage students, Aeronautics Department, University of Bristol, 18 January 1977. 1p ms notes forming new first paragraph to the above.
- C.25            'The First Fifty Years of Aeroelasticity', Royal Aeronautical Society Historical Group, 13 December 1977. 18pp typescript draft and title page with summary.

Matrix Algebra

- C.26            'Matrix Algebra', n.d. 12pp ms draft 'Purpose, date not known'.

General Scientific Topics

A chronological sequence of notes and drafts for lectures delivered between 1952-1975 to audiences of both scientists and laymen on a wide variety of subjects with a less specialised scientific content.

- C.27            'Mathematics From the Point of View of the Engineer', Bristol Mathematical Society, 8 December 1952. 2pp typescript introduction with ms notes for lecture on back of page 2.
- C.28            Lecture on Isaac Newton, Presidential address, Engineering Society, 19 February 1953. 8pp typescript synopsis with ms corrections.
- C.29            'Technical Education'. Rotary Clubs of Swindon and Bristol, 18 and 22 October 1956. 8pp typescript draft and 2pp typescript insertions for 22 October lecture.
- 'A Specification for Engineering Education', The Fourth Barnwell Memorial Lecture, 13 March 1957. 20pp typescript draft with ms corrections.
- 'Engineering Education', Southampton branch, Royal Aeronautical Society, 30 October 1957. 6pp ms notes.

Lectures, broadcasts, publications

- C.30 'Moths and Caterpillars', Presidential address on mechanical transport, Bristol University Engineering Society, 25 November 1957. 18pp typescript draft with ms corrections, and 2pp typescript account of the lecture.
- C.31 'The work of the National Council for Technological Awards', Kent Summer School, 8 August 1960. 10pp ms draft.
- C.32 'Earth, Water, Fire and Air', Presidential address on transport, Bristol branch, Royal Aeronautical Society, 5 October 1960. 19pp typescript draft with ms corrections, and 1p ms list of slides.
- C.33 'Supersonic Flight', O.L.A., 29 October 1964. 1p ms notes.
- C.34 'Technology and Change', Coombe Lodge, Bristol, 15 January 1971. 7pp ms notes (photocopy) and 4pp ms diagrams.  
  
'On the Future of Further Education', Coombe Lodge Reports vol 4, no 1 (1971). An account of Collar's lecture is given pp 17 - 24.
- C.35 'Space Exploration', Clifton College Sixth Form, 6 March 1971. 2pp ms notes.
- C.36 'Science and Society', Bristol Grammar School, 6 December 1971. 3pp ms notes and 1p diagram.
- C.37 'Social Reactions to Science', British Commonwealth Society, 11 January 1972. 7pp ms notes and 5pp diagrams.
- C.38 'Isaac Newton', Bristol Probus Club, 25 June 1974. 2pp ms notes.
- C.39 'Science, Space and Society', Evesham Rotary Club, 31 October 1972. Postcard with ms notes.  
  
'Space, Science and Society', Soroptimists, 12 November 1973. 6pp ms notes.

Lectures, broadcasts, publications

- C.40 'Science and Society', Bristol District Retirement Council, 20 May 1975. 2pp ms notes.
- C.41 'Engineering and Economics', Rolls-Royce Technical College, 16 December 1975. 1p ms notes.
- C.42 'Space', n.d. 1p ms notes.
- C.43 'Social Responsibility', n.d. 1p ms 'summary of Dainton's lecture to RMCS' delivered 8 February 1973 which Collar intended to incorporate into a lecture.
- C.44 'The folly of prognostication in aviation', n.d. 4pp ms notes and 7pp diagrams. See B.17 for ARC papers found with these notes.

Literary Topics

- C.45 Brief ms notes for eight lectures on the theme of humorous poetry delivered between 4 April 1973 - 6 September 1982.
- Extract from William Morris's A Dream of John Ball, dated 1 October 1968.

BROADCASTS

- C.46 'Supersonic Airliners', 27 June 1962. 15pp duplicated typescript copy of BBC West of England Home Service radio discussion in which Collar participated, together with related material on the sonic boom.
- C.47 'Aerodynamics Down to Earth', n.d. 4pp ms draft (photocopy) headed 'University Outlook', possibly a radio talk.

Lectures, broadcasts, publications

PUBLICATIONS

- C.48 'On centrosymmetric and centroskew matrices', Q. Jl. Mech. appl. Math. vol 15, no 3 (1962). Correspondence with A C Aitken who encouraged publication and the editors of the Quarterly Journal of Mechanics and applied Mathematics, D M A Leggett and C W Jones, 20 April 1961 - 16 January 1962.

Among the correspondence with Aitken is a letter, dated 15 May 1961, in which Aitken apologises for not replying to a letter of Collar's, explaining that the delay was due to a recurrent condition "thought by my doctor to be a long-range after-effect of 13 days in the first battle of the Somme". Aitken refers to an account of his war-time experiences, published in 1963 as Gallipoli to the Somme.

- C.49 'Education in Engineering', Western Daily Press, 14 July 1971. 3pp typescript draft.



## SECTION D SCIENTIFIC CORRESPONDENCE

- |     |  |         |
|-----|--|---------|
| D.1 | British Cellophane Ltd.  | 1965    |
|     | Reports of investigations into the performance of a chimney stack at Barrow-in-Furness, with note acknowledging payment of consultancy fee.                      |         |
| D.2 | Conn, J F C  | 1960    |
|     | Paper by Collar (and R W Traill-Nash) on the effects of shear flexibility and rotatory inertia on bending vibrations.  |         |
|     | Dubris, Yolande  | 1961    |
|     | Matrix problems.   |         |
| D.3 | Duncan, W J  | 1956-60 |
|     | Matrices, Aeronautical Research Council.   |         |
| D.4 | Dunning, J E P   | 1964-65 |
|     | Solution of geometrical problem.   |         |
| D.5 | Garrick, I E   | 1981    |
|     | Collar's letter commenting on draft paper on 'Historical Development of Flutter' by Garrick and Wilmer H Reed III and the draft paper with Collar's ms comments. |         |
| D.6 | Goodey, W J  | 1959-60 |
|     | Approximate solutions of linear second-order differential equations.   |         |
|     | Mott, N F  | 1957-58 |
|     | Correspondence re Mott's 'Elements of Wave Mechanics'.   |         |