

ROTORCRAFT SECTION REPRINTS

The following is a list of Rotorcraft Section lectures which have been published in the *Journal* up to the end of 1966. Most of them are available as reprints.

<i>Author</i>	<i>Title</i>	<i>Published</i>
Cummings, R. L.	Vertical Transport Business	April 1960
G. J. Sarsted and A. V. Coles	The Development and Flight Testing of Helicopters	April 1960
Brie, R. A. C.	Experiences with an Operational Airport	July 1960
Williams, John	Some British Research on Basic Aerodynamics of Powered Lift Systems	July 1960
Jones, J. P.	Helicopter Vibrations	Dec. 1960
Le Sueur, H. E.	Certification of Civil Transport Rotorcraft with Particular Reference to Multi-Engines	Aug. 1961
Bennett, J. A. J.	The Era of the Autogiro	Oct. 1961
Hafner, Raoul	The Helicopter—The First of the VTOL Aircraft	Dec. 1961
Lennox, S. G. and Mitchell, H. W.	Helicopter Approach Aids—Approach Guidance Instrument Flight Developments	Feb. 1962
Sullivan, N. and Simpson, J. A.	Integrated Flight Systems for Multi-Engined Transport Rotorcraft	Feb. 1962
Bell, J. C. G.	Electronic Displays for Rotary Wing Aircraft	Feb. 1962
Michel, P. L.	Sikorsky Crane Helicopter	Aug. 1962
Fitzek, R. A.	Lessons Gained in Helicopter Air Traffic Control from FAA Activities	Aug. 1962
McClements, A.	Westland Belvedere Mk. 1	Aug. 1962
Angstadt, R. S.	Operations of Chicago Helicopter Airways, Inc.	Aug. 1962
Stewart, W.	Research and Development of Rotating Wing Aircraft	Nov. 1962
Neumark, S.	Rotating Aerofoils and Flaps	Jan. 1963
Wallis, K.	The Low Cost Autogyro	Feb. 1963
Scanlon, J.	Flight Requirements for the Operation of Rotorcraft	April 1963
Nichols, J. B.	Development of the Tilt-Wing Aircraft	June 1963
Gustafson, F. B.	Powered Lift Research at Langley Field	June 1963
Fitzwilliams, O. L. L.	The Engineering Reliability of Shaft-Driven Helicopters	Aug. 1963
Poole, J.	Rotorcraft Work at the A & AEE	Aug. 1963
Heppe, R. R.	Single-Rotor Helicopter with Rigidly Mounted Blades	Oct. 1963
Miller, R. H.	Unsteady Air Loads on Helicopter Rotor Blades	April 1964
Ciastula, T. L.	The Development of the P.531	June 1964
Sibley, J. D.	Some Aspects of Turboshaft Engine Installations in Multi-Engined Helicopters	June 1964
Slocombe, A. E.	Helipport Location and Design	Aug. 1964
Mair, W. A.	The Physical Principles of Hovercraft	Oct. 1964
Morain, Paul H. L.	Development of French Helicopters	Oct. 1964
Crawford, C. C.	Light Observation Helicopter Programme of the US Army	Dec. 1964
Belinn, C. M.	The First Two Years of Operational Experience with the Sikorsky S-61	March 1965
Davidson, I. M. and Hargest, T. J.	Helicopter Noise	May 1965
Focke, Henrich	German Thinking on Rotary-wing Development	May 1965
Richards, E. J. and Sharland, I. J.	Hovercraft Noise and its Suppression	June 1965
Hewin, L. M.	The General Requirements of the Three US Armed Services for Helicopters and Other VTOL Aircraft	July 1965
Crookenden, N.	The British Army Unit Light Helicopter Project	July 1965
Hibbert, W. A.	Helicopter Trials Over Sand and Sea	Nov. 1965
Lightfoot, R. B.	The Heavy Assault Transport Helicopter	Oct. 1966

Specialists in Specials

Sealing Rings

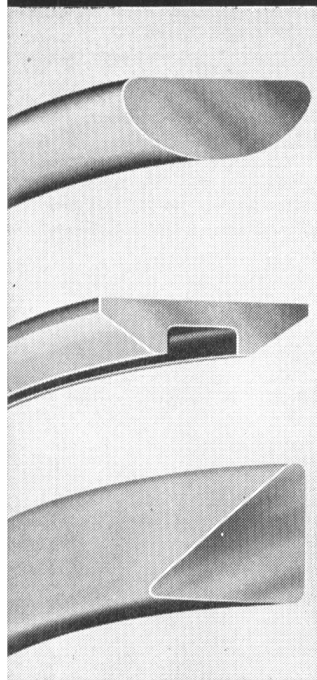
Call on Cross the specialists in design and manufacture of sealing rings for normal and high temperature application from $\frac{1}{8}$ " to 5' or even larger.

Moving or static.

Materials include Alloy Steels, Nimonic Alloys, Stellite, Aluminium and Plastics.

Outspringers and inspringers.

For further information and advice contact:



A.I.D. and A.R.B. approved

CROSS

GROSS Mfg Co (1938) Ltd
Combe Down Bath BA2 5RR
 Phone: COMBE DOWN, 2355/8
 Grams: 'CIRCLE' BATH.



University Life Assurance Society

Established 1825 Incorporated by Royal Charter

The Society offers unique advantages for life assurance to past and present members of Universities, Public Schools, and similar educational institutions within the United Kingdom, for whose exclusive benefit the Society was established.

The Society does not pay commission for the introduction of new business.

Special plans for Students or Young Graduates

The 'Minimax' Policy Reduced Premium Policy
 Young Graduates' Policy

Other plans include

Whole-life and endowment assurance

Educational Policies Children's Policies

Pension Policies

Family Protection Annuities

Unit-linked Assurances and Annuities

4 Coleman Street, London, E.C.2

Telephone: 01-606 6225

Branches throughout the United Kingdom

Marketing Management

At Watford the Rolls-Royce Small Engine Division is expanding its marketing activities for the Company's range of Small Gas Turbine Engines.

We wish to make two senior appointments in the field of Market Support; one specialising in helicopter and V/STOL aircraft and the other in general aviation.

The duties embrace world wide liaison with Aircraft Manufacturers and Operators to establish propulsion requirements. In association with these activities it will be required to undertake preliminary aircraft performance and operating analysis and to take an active part in forecasting markets for future products.

Applicants should have broad aircraft engineering experience in one of the above designated areas, with some knowledge of power plant design and installation. Previous experience in an Aircraft Project Office would have particular relevance.

Qualifications to Engineering Degree or equivalent standard would be expected together with Chartered Engineer status in appropriate professional institution. The Company offers the usual benefits associated with a major organisation and help can be given with re-location expenses where necessary.

Please write briefly in the first instance, or telephone



P. R. Stokes,
 Recruitment & Training Manager,
 Rolls-Royce Limited,
 Small Engine Division, Leavesden,
 WATFORD, WD2 7BZ, England.
 Tel. No. Garston 74000 Extn. 512

ROLLS-ROYCE
SMALL ENGINE DIVISION



LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY

Runway Dynamics of Aircraft

Applications are invited from suitably qualified graduates for a post as Research Assistant or Research Fellow on the above topic.

Railway Vehicle Aerodynamics

Applications are invited from suitably qualified graduates for a post as Research Assistant or Research Fellow on the above topic.

Salaries for both posts will be in the range £1240-£1815 depending on qualifications and experience.

Further details and application forms from Professor David Johns, Department of Transport Technology.

Loughborough

Leicestershire

SENIOR DESIGNERS

Interesting and progressive positions exist in our Design Office for work on advanced technology powered flying controls, undercarriages and general hydraulic system equipment for aircraft.

This is a unique opportunity for young men holding advanced qualifications, but more senior men with additional experience should also apply.

Attractive salaries and working conditions, participation in Company Profit Sharing and Pension Schemes, Canteen, Sports and Social facilities.

Applications, in writing, giving details of age, qualifications and experience, should be submitted to the Personnel Manager,



LOCKHEED PRECISION
PRODUCTS LTD
Shaw Road, Speke
Liverpool L24 9JY

CARPETS

for aircraft, passenger reception, airline offices, flying clubs, etc.

All leading makes of Branded Carpets

WILTONS • AXMINSTERS • TUFTED • ORIENTALS
at Highly Competitive contract prices

Expert fitting service and free delivery throughout UK
Over £200,000 stocks in our London showrooms

Private individuals in the aircraft industry may purchase
from us at up to 30% DISCOUNT

Dodson Bull CARPET
CO LTD 

Please write to Dept. RAS

LONDON: 5 & 6 Old Bailey, E.C.4. Tel: 01-248 7971 (10 lines)
NEWCASTLE-UPON-TYNE: 83-89 Blakett St. Tel: 20321/21428
MANCHESTER: 55-61 Lever Street. Tel: 061-236 3687/8/9

DIRECTORY OF ADVERTISERS

AIRCRAFT MATERIALS LTD. Midland Road, London, N.W.1.	01-387 6151
BEAGLE AIRCRAFT LTD. Shoreham Airport, Shoreham-by-Sea, Sussex.	Shoreham 2301 0664-74 321
B.P. AVIATION SERVICE, SHELL-MEX AND B.P. LTD. Shell-Mex House, Strand, London, W.C.2.	01-836 1234
BRISTOL ENGINE DIVISION, ROLLS-ROYCE London Office: Mercury House, 195 Knightsbridge, S.W.1.	01-589 7090 0272 693871
Bristol: P.O. Box 3, Filton, Bristol. Coventry: P.O. Box 17, Coventry, Warwickshire.	0203 28666
BRITISH AIRCRAFT CORPORATION 100 Pall Mall, London, S.W.1.	01-930 1020
BRITISH OVERSEAS AIRWAYS CORPORATION Head Office: London Airport, Hounslow, Middx	01-759 5511
CHATTO & WINDUS 42 William IV Street, London, W.C.2.	01-836 7669
CROSS MANUFACTURING CO. (1938) LTD. Combe Down, Bath, Somerset.	02213 2355/8
THE DECCA NAVIGATOR COMPANY LTD. 9 Albert Embankment, London, S.E.11.	01-735 8111
DOWTY GROUP LTD. Cheltenham, Glos.	0452 21511
THE DUNLOP CO. LTD. AVIATION DIVISION Holbrook Lane, Foleshill, Coventry.	0203 88733
ELECTRO-HYDRAULICS LTD. Liverpool Road, Warrington.	0925 35922
HAWKER SIDDELEY AVIATION LTD. Richmond Road, Kingston upon Thames 32 Duke Street, St. James's, S.W.1.	01-546 7741 01-930 2084
HIGH DUTY ALLOYS LTD. Slough, Bucks.	75 23901
HOBSON, H. M., LTD. Hobson Works, Fordhouses, Wolverhampton.	09078 2381
IRVING AIR CHUTE OF GREAT BRITAIN LTD. Icknield Way, Letchworth, Herts.	04626 6282
PERGAMON PRESS LTD. Headington Hill Hall, Oxford.	0092 64881
PITMAN, SIR ISAAC & SONS LTD. 39 Parker Street, London, W.C.2.	01-405 9781
ROBERT RILEY LTD. Milkstone Spring Works, Rochdale.	0706 44551
ROLLS-ROYCE LTD. P.O. Box 31, Derby DE2 8BJ. 14-15 Conduit Street, London, W.1.	0332 42424 01-629 6201
ROSEMOUNT ENGINEERING CO. LTD. Durban Road, Bognor Regis, Sussex.	Bognor Regis 4101-4
ROTAX LTD. Willesden Junction, London, N.W.10.	01-965 7777
SAUNDERS VALVE COMPANY LTD. Aircraft Division, Widemarsh Common, Hereford.	0432 3125-8
SHELL AVIATION SERVICES, SHELL-MEX AND B.P. LTD. Shell-Mex House, Strand, London, W.C.2.	01-836 1234
SMITHS INDUSTRIES LTD. (AVIATION DIVISION) Kelvin House, Wembley Park Drive, Wembley, Middx.	01-902 8888
UNION CARBIDE U.K. LTD. Flame Plating Department, Millers Road, Warwick.	0926 41760
UNIVERSITY LIFE ASSURANCE SOCIETY 4 Coleman Street, London, E.C.2.	01-608 6225
WESTLAND HELICOPTERS LTD. Yeovil, Somerset.	0935 5222

SMELT, R.

Looking Ahead In Aeronautics—A US View

This paper is a follow-up to the Second Century series, giving the American view of the next one hundred years. Included are comments on technological forecasting in general, developments in Space Flight—the ballistic missile, communications satellite, the meteorological, navigational and earth resources satellites. Air Transport—airline growth and aircraft size, transport aircraft speed, adverse aspects of Air Transport, V/STOL aircraft—military, commercial, personal aircraft.

FLEMMING, M. and SCHOLTEN, R.

Noise Problems of VTOL with Particular Reference to the Do 31

Development trends in modern aircraft and the steady increase of air traffic have made aircraft noise a problem.

The paper shows how the noise problem can be influenced by the VTOL technique, and comprehensive noise calculations and measurements of the VTOL jet transport aircraft Do 31 are made public for the first time. The noise sources at VTOL aircraft and their correlation are explained. From the comparisons with the tests can be seen how the accuracy of the noise carpets of VTOL aircraft can be determined by calculations.

With the aid of this knowledge, further possibilities of noise reduction are described for future VTOL projects of the Dornier company. These possibilities refer to the use of mixing nozzles, new types of lift-pods, future engines as well as appropriate take-off and landing techniques. As far as possible, some comparisons with propeller-driven VTOL aircraft are made.

DORNIER, S.

Review of Post-War Research and Development at Dornier

When conditions permitted the resumption of aircraft construction on a small scale, Dornier started to develop, with the Do 27, a light all-round and liaison STOL aircraft, based on previous design work on the Do 25 in Spain.

The problems and possibilities of STOL techniques were studied with the twin-engined Do 28 of which various versions were built, and with the experimental Do 29 which was equipped with tilting propellers as a means for vectorising thrust.

The continuation of the studies for STOL aircraft concepts with the consideration of military operational requirements led to the design and development of the Do 31 VTOL jet transport.

Dornier-Werke have also been working on helicopters and the Do 32 one-man helicopter is well-known.

In view of the problems and tasks in the field of guided missile and space techniques, the Dornier-System GmbH was established a few years ago to co-ordinate the work in this field. Experimental studies in connection with the problem of rain erosion at high air speeds, and the possibilities and problems encountered in the development of retractable Rogallo wings are discussed.

WEST, R. G.

Fan Lift In VTOL Design

For some years it has been evident that a VTOL medium-range air liner could make a major contribution to the future growth of civil air transport. To gain the maximum journey time-saving which would be available with a VTOL system, the aircraft should be operated from "vertiports" which are situated fairly near to the city centres. Recent work at Rolls-Royce has shown that it should be possible to achieve the required noise levels and mechanical reliability for operation in an urban environment.

The basis of a successful VTOL aircraft is the powerplant. This is especially true in the case of the lift-fan aircraft, with a large number of engines installed in each airframe. The final design of the Rolls-Royce RB.202 Advanced Lift Fan is aimed at the best compromise between the engine thrust size, weight, noise level, and production cost. The design targets for the RB.202 Lift Fan are stated, and some important design trends are shown. The mode of operation, together with the estimated noise levels, reliability, and installation features of a lift-fan VTOL civil aircraft are discussed.

SATRE, P.

Supersonic Air Travel—Present and Future

A Study on Air transport requirements during the 1970s shows that a big market is available for supersonic aircraft. These aircraft—and particularly the Concorde—will be capable of meeting the passengers' requirements for security and speed. However, a special effort on ground handling of passengers will be necessary to draw full benefit from high speed in flight. Later on, during the 1980s, the technical progress should enable the supersonic aircraft to meet also the passengers' economy requirements, that cannot be satisfied from the onset owing to the complexity of problems.

If united, European Industry is capable of achieving such technical progress.

PINSKER, W. J. G.

The Theory and Practice of Inertia Cross-Coupling

Inertia cross-coupling is a condition peculiar to the modern highly-loaded and elongated aircraft. It can manifest itself in three distinct forms: roll-yaw-pitch coupling in aileron rolls, autorotation, and pitch-roll coupling in response to rudder. The mechanisms underlying these phenomena are discussed and possible remedies are considered. The remainder of the paper is devoted to a discussion of the part played by the aircraft designer and the test pilot in the process of establishing the flight limitations of an aircraft subject to inertia cross-coupling.

CRAGO, W. A.

Marine Safety Aspects of Helicopters

The differing safety aspects of land-based and amphibious helicopters flying over the sea are discussed with reference to the various civil and military roles they are expected to undertake.

A short historical description of the experimental investigation of ditching characteristics is followed by a discussion of model testing techniques. The various aspects of design likely to be important for water-borne operation of amphibious helicopters are described and it is shown that a number of these are also of importance in the case of machines ditched in an emergency. The generation and characteristics of sea waves are briefly discussed and the results of model experiments are used to illustrate how they affect the floatation and other characteristics of water-borne helicopters or land-based machines with and without emergency floatation equipment.

Ditching procedures are described, together with their relationship to the human aspects which decide whether or not the occupants of the aircraft will be injured or able to vacate the machine before it sinks.

The paper closes with a brief discussion of the available statistics on the frequency of system or engine failure experienced in practice which could lead to crashing or ditching.

PHILLIPS, F. C.

The Canadair CL-84 Tilt-Wing V/STOL Programme

In 1963 the Canadian Government and Canadair contracted to share the cost of designing and developing the CL-84 prototype to the point where flight demonstrations to military agencies could be made. The CL-84, a two-engined tilt-wing/slipstream-deflection V/STOL aircraft, was the product of a number of prior years of Canadair V/STOL research and development work, particularly in model propeller and aircraft testing, control system concepts, and flight simulation. The paper highlights briefly those portions of the earlier programme that were significant in defining the CL-84 for detail design.

Having described those elements of the aircraft that are least conventional, the paper goes on to outline the ground and early flight testing. Considerable attention is then paid to the experience gained in the flight test programme. The CL-84-1 aircraft now being manufactured for evaluation by the Canadian Armed forces is delineated. An indication is given of the significant improvements that can be provided in the aircraft type within the current state-of-the-art, and alternatively with incorporation of technical advances expected within the next five years.



SEARCH & RESCUE....

one of the important roles of the Westland Sea King helicopter, supported by



- * Search Radar
- * Long Range
- * Twin Engine Safety
- * All weather operation
- * Ample cabin space — 25 seats or 12 stretchers
- * High capacity rescue winch
- * Boat Hull



**WESTLAND
HELICOPTERS
LIMITED**

YEovil SOMERSET ENGLAND



SUBSIDIARY OF WESTLAND AIRCRAFT LIMITED

Our nest eggs are aluminium.



And they save you money, like everything we hatch in aluminium. All in the same H.D.A. clutch are forgings, die-castings, extrusions and sheet – in various shapes and for many uses.

We know we can help you so drop us a line and we'll gladly tell you more.

 **HAWKER SIDDELEY
HIGH DUTY
ALLOYS LTD.**

89 BUCKINGHAM AVENUE, SLOUGH, BUCKINGHAMSHIRE.

Hawker Siddeley Group supplies mechanical, electrical and aerospace equipment with world-wide sales and service.