NOTICE OF ILLEGIBLE DOCUMENT

ON THE MICROFICE RECORD

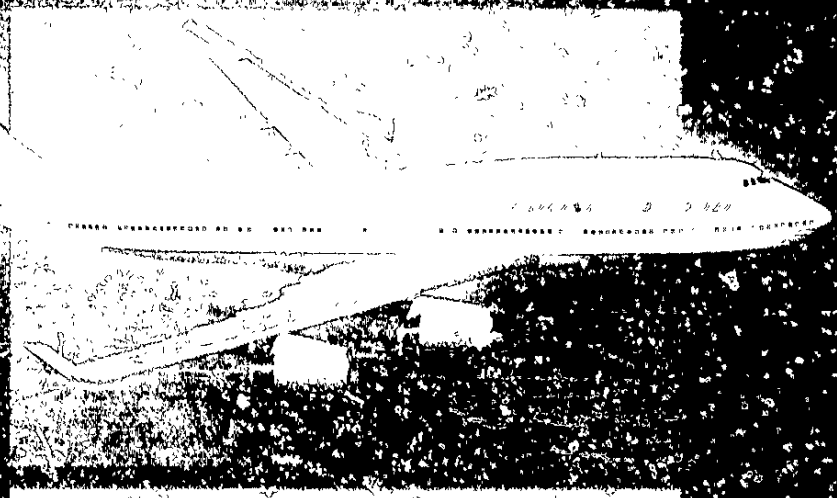
Companies House regrets that the microfiche record for this company contain some documents which are illegible.

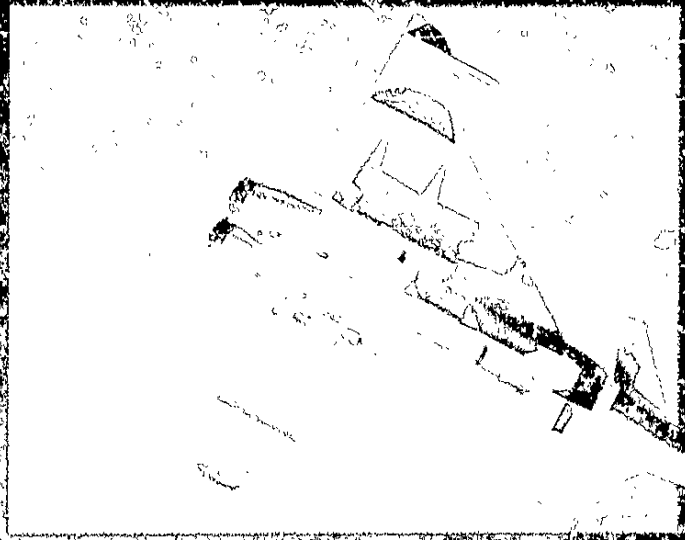
The poor quality has been noted, but unfortunately steps taken to improve them were unsuccessful.

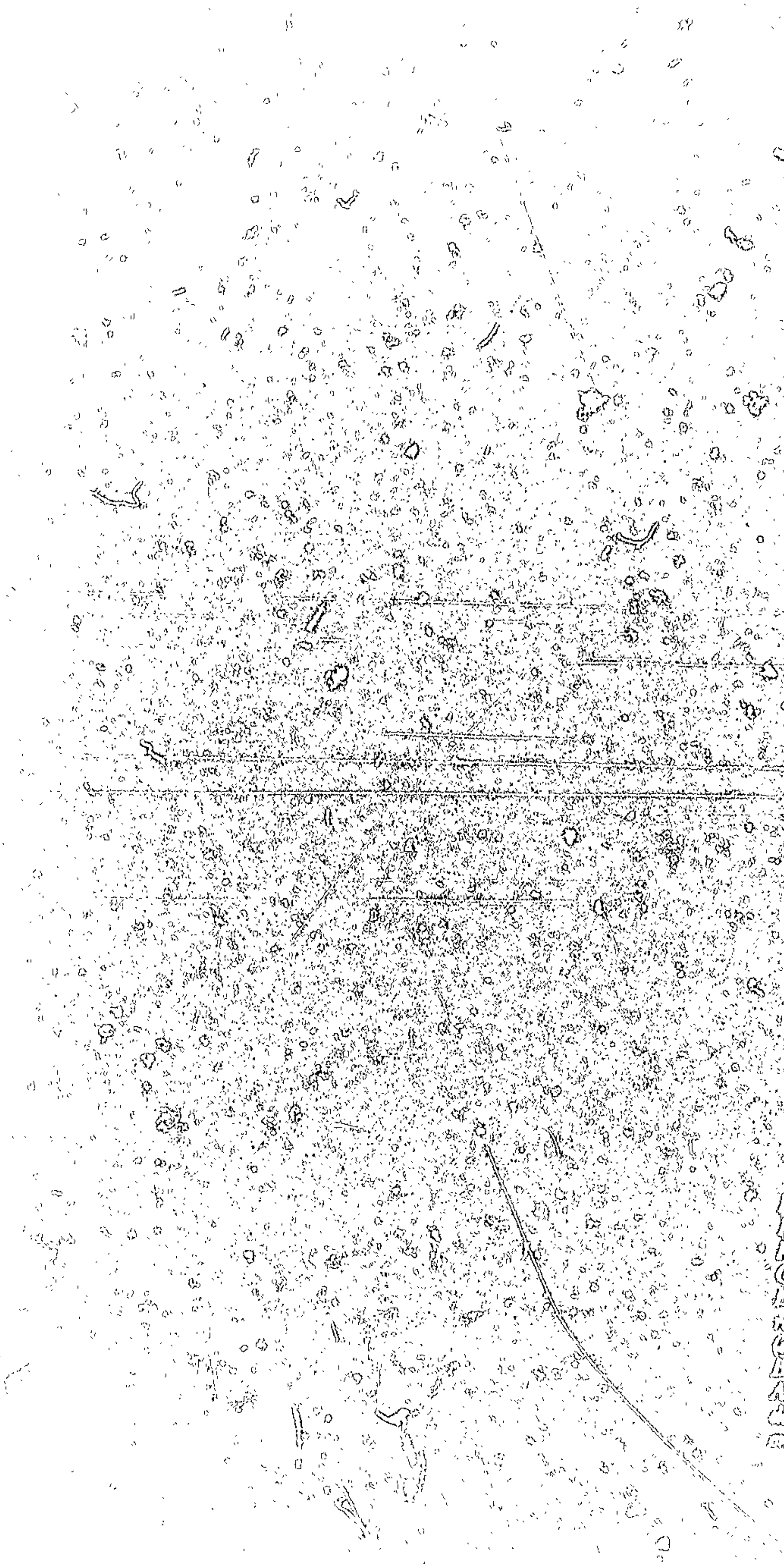
Companies House would like to apologise for any inconvenience this may cause.

Company Number 1003142

ROLLS-ROYCE p.l.c.
ANNUAL REPORT 1986

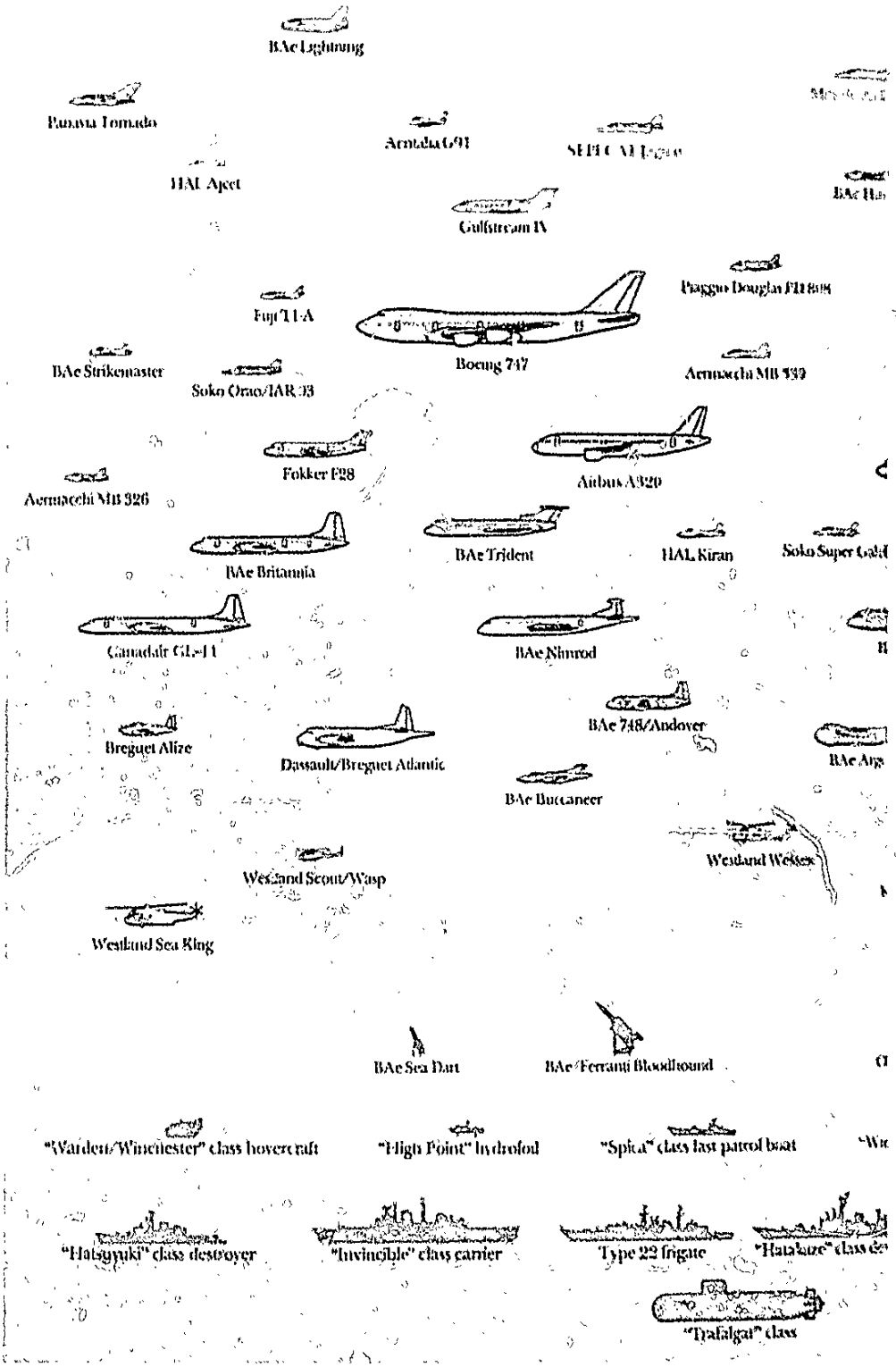






Front cover: Two major events of 1986 were the launch of the RB211-524D4D engine by Cathay Pacific Airways and British A[illegible]

Rolls-Royce Power



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BAe Canberra
BAe VC-10
BAe 125 Dominie
Gulfstream II
BAe Hawk
Fokker 100
BAe/Rombac One-Eleven
GD Convair 600
Aerospatiale Caravelle
Gulfstream I
Aeritalia G222
Transall C-160
Fokker F27/Fairchild FH227
Sheet Belfast
HP Herald
NAMC YS II
BAe Viscount
BAe Harrier
Vought A-7
Agusta-Bell 204/205
Westland Lynx
Westland Commando
Agusta A129 Mangusta
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Gas and oil pumping
Electrical generation
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"Estahilla" class corvette
"Niteroi" class frigate
Type 21 frigate
"Al" class frigate
New DD destroyer
"Kortenaer" class frigate
Type 42 destroyer
"George Leygues" class destroyer
"Tromp" class destroyer
Type 23 frigate
"Swiftsure" class
"Valiant" class
"Resolution" class

Company Profile

Rolls-Royce is one of the major aero-engine manufacturers in the western world and one of only three with the proven capability to produce the largest aero engines. Its engines are in service with more than 270 airlines, 110 armed services and 700 executive and corporate operators.

The Group also has over 175 industrial customers and produces gas turbines for power generation, gas and oil pumping and other industrial duties. Its gas turbine engines power warships for 25 navies, and its subsidiary, Rolls-Royce and Associates Limited, is responsible for the design and supply of nuclear steam raising plant for the Royal Navy's nuclear-powered submarine fleet.

In all over 1,200 customers operate more than 27,000 Rolls-Royce gas turbines. The Group employs more than 42,000 people worldwide, of which over 90 per cent work in the United Kingdom. The parent Company, Rolls-Royce plc, is organised into three main business groups – Civil, Military and Industrial and Marine – responsible for the management and profitability of their respective areas of business and supported by the Corporate Engineering and Supply Groups.

The Company's business dates back to before 1906 and aero engines were first produced in 1915. Today its principal civil engines are the RB211, which powers the Boeing 747 and Lockheed TriStar airliners, the 535 which powers the Boeing 757 and the Tay for the new Fokker 100 airliner and the new Gulfstream IV executive jet. The Company is also a member of a major collaborative project which includes companies from five nations working together to design and build the V2500 engine, due to enter service in the 150-seat Airbus A320 in 1989; Rolls-Royce has a 30 per cent share in this programme.

On the military side the main engine programmes are the Pegasus for the Harrier and AV-8B; the Turbo-Union RB199 for the three-nation Tornado strike and air-defence aircraft; the Rolls-Royce Turbomeca Adour for the Hawk and Jaguar; the Viper for trainer and strike-aircraft; and the Gem, Gnome and RTM322 for helicopters. Rolls-Royce is also engaged in a collaborative programme aimed at supplying an advanced engine for the proposed new European Fighter Aircraft (EFA) which is currently in the definition phase.

The wide range of applications for Rolls-Royce products is displayed opposite.

CHAIRMAN'S STATEMENT

I am pleased to report another year of record sales, with profitability continuing to improve for the third successive year.

Turnover exceeded £1.8 billion, an increase of 12.5 per cent over 1985, while operating profit at £273 million showed a rise of 29 per cent. Profit on ordinary activities before tax increased by £39 million to £120 million. At the end of 1986 outstanding orders amounted to £3.1 billion.

The increased output in 1986 was achieved with a negligible rise in manning levels, an indication of the ongoing benefits from the Company's policy of concentrating its capital investment both in advanced manufacturing technology and in more powerful support facilities for our research and development organisation.

Once again the civil airliner sector of the market contributed the major part of the growth in turnover, and with a substantial intake of orders during the year, the prospects of continued growth are encouraging.

Of particular significance was the launch by Cathay Pacific Airways of the RB211-524D4D engine in the B747-400. In June the Hong Kong based airline ordered two of this latest version of Boeing's successful jumbo jet; the subsequent announcement in August by British Airways that they were ordering sixteen B747-100s, also with Rolls-Royce -524D4D engines, confirmed the appeal of this aircraft/engine combination, where reliability and fuel economy are all-important.

The first major milestone in the development of the -524D4D, which is designed for 58,000lb of thrust for the 747-400 application, was achieved on target in January 1987 when the engine made its first test bed run.

Military business remained at much the same level as in 1985, with deliveries of engines and spare parts continuing in support of European and United States defence needs; initial deliveries were also made under the Saudi Arabian contract announced in 1985 for Tornado and Hawk aircraft, both powered by Rolls-Royce engines.

The preliminary evaluation work on the engine design for the proposed new European Fighter Aircraft (EFA) is proceeding well in collaboration with our German, Italian and Spanish partners, and it is hoped that full-scale launch of the development programme will be authorised later this year. In parallel with this work, the Company ran its XG40 demonstrator engine for the first time in December; this project, which is jointly funded by Rolls-Royce and the Ministry of Defence, is being used to prove areas of new technology which it is proposed to incorporate in the EFA engine.

Industrial gas turbine sales have been adversely affected by the collapse of oil prices and the resultant cut-back in requirements for the oil-field power generating equipment, both on-shore and off-shore. Gas and oil pumping requirements have also been severely reduced, but marine business has held up well, with the Spey proving its worth in service with the Royal Navy's Type 22 frigate.

Our manufacturing and engine overhaul facilities in North America and Brazil continued to contribute to the Group's sales and operating profit, but against a background of increasing competition.

While 1986 saw the delivery of the last Dart and Spey engines for airline service, it was a year of significant progress for the Spey's successor, the Tay. This engine received its full flight certificate from the Civil Aviation Authority in June, it flew in the Fokker 100 on its maiden flight in November, and in the same month GPA, Mitsubishi and Fokker announced their intention to form a leasing company, GPA Fokker 100 Limited and to order 10 of the Fokker aircraft powered by Tay engines; an up-rated version of the engine, the Mk650, exceeded its thrust rating on its first test bed run in December.

In addition to
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Sir Francis Tombs
March 19, 1987

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In addition to specific engine project developments, the Company has been giving attention to advanced propulsion concepts such as SuperFan (based on the V2500 core), and various possible designs of ultra high by-pass ratio (UHBR) engines, which are aimed at entry into airline service in the mid 1990s. The Company's preliminary ideas were on display at the 1986 Farnborough Air Show, and attracted keen interest from many quarters. Engineering activity is continuing at an increasing rate with a view to defining more closely the options to be offered to the major airframe manufacturers.

The Farnborough Air Show also provided an opportunity of demonstrating our latest helicopter engine, the RTM322, which powered a Sikorsky S70C flight test vehicle, while the RB199 showed its versatility in the British Aerospace Experimental Aircraft Programme demonstrator.

For the second year running, the Company received a Design Council award, this time for its RB211 high pressure turbine blade which is produced by a directionally-solidified casting process, and which has achieved lives of over 13,500 hours in continuous airline service. The Pollution Abatement Technology Award was also received by the Company for its work on the quiet, clean and fuel-efficient 535 engine.

The agreement with General Electric (USA), under which Rolls-Royce participated in the CF6-80C2 programme and General Electric in the 535E4 programme, was terminated in November because of the increasing overlap in the products of the two companies covered by the agreement. However, both companies will continue to manufacture engine components for each other under revised arrangements.

Our move back into the private sector took a further step in December, when the Secretary of State for Trade and Industry, the Right Honourable Paul Channon MP, confirmed the intention of Her Majesty's Government to privatise Rolls-Royce in the second quarter of 1987, and also announced the basis of the Company's capital structure on flotation. He stated that at the time of the offer for sale, the Government will subscribe for additional shares in the Company equivalent to the consolidated net borrowings plus finance lease obligations as recorded in the audited Accounts for 1986.

This will provide Rolls-Royce with the strong balance sheet it needs to maintain and improve its position in the competitive airline market, where the ability to arrange major financing is essential. At the same time, the assurances previously given by the Government in relation to Rolls-Royce's financial obligations will be withdrawn.

The prospects for 1987 are encouraging: we have a strong order book, there is a large civil and military engine market to be satisfied, and we have a broad product range with which to compete. Add to this a steady growth in productivity over the past five years, improved financial accountability, an experienced management team and a skilled workforce, and I am confident that we have the ingredients for a successful future.

The recovery of the past few years could not have been achieved without the unremitting efforts of our employees. We are fortunate in having a loyal and conscientious workforce which is essential to the high-technology industry to which we belong.

Francis Tombs

Sir Francis Tombs
March 19, 1987

The Company's headquarters and registered office in London

Chairman

Sir Francis Tombs, BSc(Econ), FEng, FIMechE, FIEE, FInstEnergy joined the Board in 1982 and was appointed Chairman in February 1987. He is also Chairman of Turner & Newall PLC and AE PLC and a Director of N M Rothschild & Sons Limited, and Shell UK Limited.

Sir Francis has had a distinguished career in engineering and business. He has been Director of Engineering and Chairman of the South of Scotland Electricity Board, Chairman of the Electricity Council for England and Wales and Chairman of the West Group PLC. Knighted in 1979, Sir Francis is also a Commander of the Engineering Council and of the Advisory Council for Applied Research and Development (ACARD).

Managing Director

Ralph H Robins, BSc(Eng), CEng, MIMechE, ACGI joined the Board in 1982 and was Director – Civil Engines from July 1983 until November 1984, when he was appointed Managing Director. He has spent 31 years with Rolls-Royce as an engineer and on commercial duties in the United States and Britain. His appointments include Assistant General Manager – Marketing, Aero Engine Division, 1976; Executive Vice President of Rolls-Royce, Vice President for Civil and Marketing Director of the Industrial and Marine Division in 1982. He was appointed Commercial Director of the Company in 1983.

Mr Robins is President of the Society of British Aerospace Companies, SBAC, and a Governor of the Defence Industries Council. Age 51.

Secretary
Anthony Warrington

Registered Office
65 Buckingham Gate
London SW1E 6AT

Non-Executive Directors

Sir Arnold Hall, FPS, MA, FEng, FAIAA, FIMechE, ACGI, FIEE, FRAeS was elected to the Board in 1983. He was Chairman of Hawker Siddeley Group PLC from 1967 until 1986. Age 71

Air Chief Marshal Sir Douglas Lowe, GCB, DFC, AFC, CRAeS was elected to the Board in 1984. He has been Controller – Aircraft and Chief of Defence Procurement with the Ministry of Defence. Age 65.

Harold G Mourgue, FCA* was elected to the Board in 1985. He is Vice-Chairman of Thorn EMI plc, Chairman of INMOS International plc, a Non-Executive Director of Turner & Newall PLC and of Thames Television PLC. Age 59.

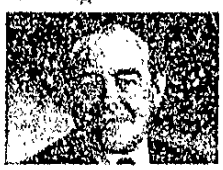
Sir Robin Nicholson, FRS, FEng was elected to the Board in 1986. He was Chief Scientific Adviser to the Cabinet Office and he is an Executive Director of Pilkington Brothers plc. Age 52.

Sir Philip Shelbourne,* a barrister, was elected to the Board in 1986. He was Chairman and Chief Executive of The British National Oil Corporation and he is Chairman of Britoil plc. Age 62.

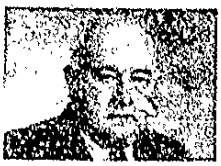
Sir Arnold Hall

Sir Douglas Lowe

Harold Mourgue



Sir Robin Nicholson



Sir Philip Shelbourne

Executive Directors

James O Keir, CEng, FIMechE, FRAeS
Director – Civil Engines
Elected to the Board in 1984. He joined Rolls-Royce in 1961 and has held posts in manufacturing and general management, prior to being appointed Programme Director RB211-524 and subsequently Operations Director – Civil Engine Group. Age 47

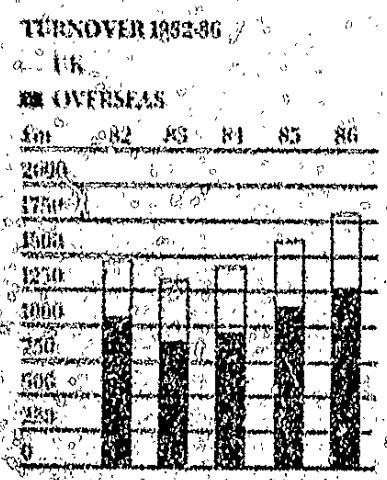
Stewart C Miller, BSc(Eng), CEng, MIMechE, FRAeS
Director – Corporate Engineering
Elected to the Board in 1985. He joined Rolls-Royce in 1954 and his appointments have included Chief Engineer and then Head of Project for the RB211-535 prior to becoming Director of Advanced Engineering. Age 52.

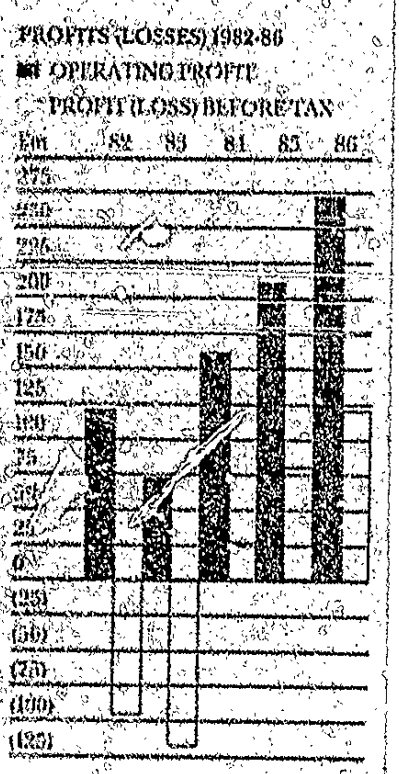
James A Rigg, FCA*
Financial Director
Elected to the Board in 1982. He joined Rolls-Royce in 1953 and from 1978 to 1982 he was Commercial Director of the Company's Aero Division. He is Chairman of the Trustees of the Pension Fund and also of Rolls-Royce and Associates Limited. Age 60.

F Trevor Salt, CBE, FRAeS
Director – Supply
Elected to the Board in 1980. He joined Rolls-Royce in 1941 and has held a range of production and management appointments, including General Manager Bristol Engine Group, Company Manufacturing Director and Operations Director – Aero Division. Age 61.

John D Wragg, BSc(Eng), CEng, FIMechE, FRAeS
Director – Military Engines
Elected to the Board in 1981 as Director – Corporate Engineering. He joined the Bristol Aeroplane Company Ltd in 1952; with Rolls-Royce he has held several senior posts including Director of the Bristol Operations. Age 58

Member of the Audit Committee





Turnover

Turnover rose by £201 million in 1986 reaching a record level of £1,802 million; this represented a 12.5 per cent increase over the 1985 figure of £1,601 million. Overseas business accounted for 71 per cent of sales in line with 1985.

The civil sector of the business showed substantially the greatest improvement with sales increasing by £180 million to £757 million, a rise of 31 per cent compared with 1985. Engines and spare parts both contributed to the higher level of activity, with the RB211-524 showing the biggest sales growth over 1985. Although 1986 was the year in which the last sales of Spey and Dart engines were made, it was also the year in which deliveries of the Tay engine commenced; this is the successor engine to the Spey, with orders received for over 570 engines by the end of 1986.

Military sales, at £740 million, remained at much the same level as in 1984 and 1985. Within the overall total, however, there were increased deliveries of Pegasus and RB199 engines, offset by lower levels of activity on the Viper and Adour.

In the industrial and marine area sales increased by 7 per cent to £153 million, a satisfactory performance taking into account the depressed state of the power generation and oil and gas markets.

Profits

Operating profit amounted to £137 million, an increase of 24 per cent over 1985; in relation to turnover, operating profit improved from 7.2 per cent in 1985 to 7.6 per cent in the year under review.

The 31 per cent growth in civil turnover contributed to an even greater increase in operating profit, which at £137 million represented an 88 per cent improvement over the 1985 figure of £73 million. The contribution from military business also increased, while the drop in industrial and marine profits, although to a level higher than 1984, reflected the competitive pressures in a relatively static market.

With the exception of a proportion of the costs of production tooling, which are written off over five years, all expenditure associated with the launch of new civil engine projects continued to be charged as incurred.

Net interest charges reduced by £8 million to £21 million, reflecting lower average borrowings compared with 1985.

Profit before tax amounted to £120 million, a rise of 48 per cent over the 1985 figure of £81 million, and a continuation of the improving trend achieved since 1983.

Research and Development

Gross research and development expenditure amounted to £255 million in 1986, an increase of 9 per cent over 1985, and a reflection of the continuing high level of activity on both civil and military engine projects, supplemented by work on advanced engineering programmes.

The net research and development charge, at £132 million, represented 7 per cent of turnover, compared with 6 per cent in 1985, but was similar to the 1984 level. The only project which received launch aid support from Her Majesty's Government (HMG) in 1986 was the V2500; no further support is due on any of the Company's current civil projects.

Launch aid is recoverable by HMG in accordance with arrangements under which the Company pays an agreed levy on sales arising on the supported projects. In 1986 levies paid to HMG in respect of past launch aid amounted to £21 million and were charged to cost of sales.

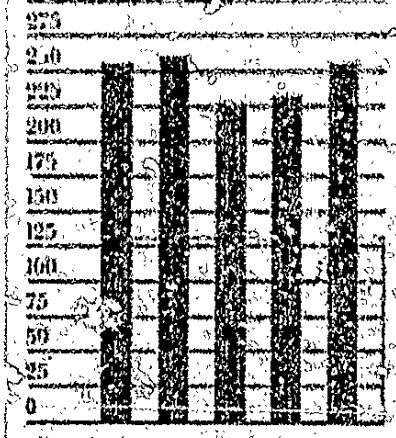
An additional £7 million was also charged to cost of sales for amounts paid to HMG on overseas military sales in respect of engine projects which had previously been developed under contracts awarded by the Ministry of Defence.

Funds generated from Operations

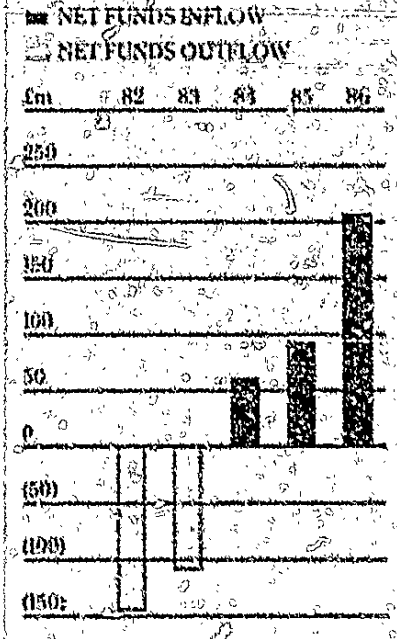
Funds generated from the Group's operations amounted to £206 million compared with £93 million in 1985 (see Source and Application of Funds Statement on page 36), a continuation of the improving trend apparent since 1982.

The use of these funds for fixed asset investment and working capital needs led to a small increase in net borrowings of £20 million. The most significant investments were made in advanced manufacturing and testing facilities and supporting computing equipment, while the demand for working capital reflected the increased level of business activity associated with the growth in new orders.

RESEARCH AND DEVELOPMENT 1982-86



FUNDS GENERATED FROM OPERATIONS 1982-86



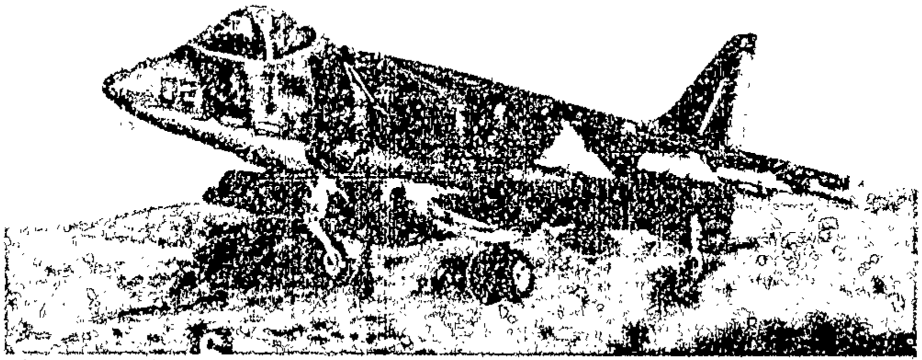
Five-Year Review

Consolidated profit and loss account

	1985 £m	1984 £m	1983 £m	1982 £m	1981 £m
Turnover	1,802	1,661	1,409	1,341	1,195
Operating profit	273	211	162	71	122
Research and development (net)	(132)	(109)	(101)	(141)	(131)
Interest payable and similar charges	(21)	(29)	(35)	(6)n	(8)1
Share of losses in related companies	–	(1)		(2)	
Profit (loss) before taxation	120	81	26	(115)	(93)
Taxation	1	(3)	(5)	(4)	(1)
Profit (loss) after taxation	121	78	21	(119)	(97)
Attributable to minority interests	(1)	(1)	(1)	(1)	(1)
Net restructuring costs				(74)	(38)
Profit (loss) attributable to Rolls-Royce plc	120	77	20	(194)	(136)

Consolidated balance sheet

Fixed assets	405	383	382	393	390
Current assets	940	838	800	756	920
	1,345	1,221	1,182	1,149	1,310
Liabilities and provisions	(823)	(818)	(857)	(846)	(813)
	522	403	325	303	497
Share capital	127	127	508	508	508
Reserves	390	272	(188)	(210)	(16)
	517	399	320	298	492
Minority interests	5	4	5	5	5
	522	403	325	303	497



Over 60 AV-8A Harriers, powered by Pegasus engines, have been [illegible] the United States Marine Corps

advanced exhaust nozzles for STOL aircraft; crack propagation in advanced alloys; advanced lift engine and high speed propulsion concepts; turbine blade-cooling technology; and the tolerance of the Pegasus engine to wide specification fuels. Important work is also being carried out on the design and manufacture of high-temperature parts in composite materials for advanced gas turbines.

Rolls-Royce Inc is responsible with the Thermo Electron Corporation for operation of the co-generation plant at the Dade County Government Center, Miami. It incorporates an SK30 Industrial Olympus and provides the electrical power and thermal energy for this large building complex.

Canada

During 1986 Rolls-Royce Industries Canada Inc and its operating subsidiaries have expanded their operations in selected areas and increased their capabilities to secure future business.

Bristol Aerospace Limited at Winnipeg employs about 1,100 people. It is setting up a new facility to expand its resources for numerical-control machining augmented by machinery being transferred from Rolls-Royce (Canada) Limited, Montreal. This new facility will permit Bristol Aerospace to increase its aerospace sub-contract workload while maintaining its position as a major Canadian defence contractor in the aircraft repair and overhaul, rocket, space and missile fields.

Bristol Aerospace repairs and overhauls military aircraft and helicopters, and produces a range of aircraft products, nuclear and airframe components, military electronics, research rockets and ground-to-air missiles.

Rolls-Royce (Canada) Limited (RRC) at Montreal, which employs approximately 700 people, provides engine repair and overhaul services for airline and executive and corporate aircraft operators and the military. It also produces and overhauls industrial gas turbines.

RRC commissioned a new large-engine test cell in October. This will permit its repair and overhaul activities to be extended to the Tay and large engines such as the RB211 family.

Brazil

In South America, Motores Rolls-Royce Limitada (MRR), a wholly owned subsidiary based in Sao Paulo, employs 180 people on support of the 1,000 Rolls-Royce engines in the region.

During 1986 there was an increase in MRR's capability for the overhaul of the Gem engine to support the Brazilian Navy's Lynx helicopters. The platform-based Avon engines operated by Petrobras are also supported from Sao Paulo.

For the Italian-Brazilian AMX close support fighter programme, MRR is working closely with the Brazilian organisation CELMA on the manufacture of Spey MK807 parts for this aircraft.

Trajectory of a Black Brant three-stage rocket, built by Bristol Aerospace and launched from Alaska to an altitude of 1,582km to carry out auroral research

Consolidated Profit and Loss Account

For the year ended December 31 1986

	Notes	1986 £m	1985 £m
Turnover	2	1,802	1,901
Cost of sales		(1,369)	(1,275)
Gross profit		433	626
Commercial, marketing and product support costs		(82)	(97)
General and administrative costs		(78)	(78)
Operating profit	3	273	451
Research and development (net)		(132)	(190)
Interest payable and similar charges	4	(21)	(21)
Share of losses in related companies		(1)	(1)
Profit on ordinary activities before taxation	4	120	89
Taxation	5	1	(31)
Profit on ordinary activities after taxation		121	58
Attributable to minority interests		(1)	(1)
Profit attributable to Rolls-Royce plc	24	120	57
Earnings per share	6	23.6p	15.2p

The Company profit and loss account is not shown – Section 228(7) Companies Act 1985

The notes on pages 37 to 52 form part of these accounts

BALANCE SHEETS

at December 31 1986

	Notes	Group 1986 £m	Group [illegible] £m	Company 1986 £m	Company [illegible] £m
Fixed assets					
Tangible assets	[illegible]	405	[illegible]	334	[illegible]
Investments:					
Shares in group companies	[illegible]	—		23	[illegible]
Shares in related companies	[illegible]	—		—	
		405	[illegible]	357	[illegible]
Current assets					
Stocks	[illegible]	604	[illegible]	556	[illegible]
Debtors	[illegible]	315	[illegible]	615	[illegible]
Cash at bank and in hand		21	[illegible]	1	[illegible]
		940	838	1,172	748
Creditors – amounts falling due within one year					
Bank loans, overdrafts and other borrowings	16	(171)	(180)	(128)	(112)
Other creditors	17	(367)	(379)	(425)	(351)
Net current assets		402	279	619	285
Total assets less current liabilities		807	662	976	580
Creditors – amounts falling due after more than one year					
Bank loans and other borrowings	18	(79)	(62)	(66)	(52)
Other creditors	19	(103)	(118)	(359)	(116)
Provisions for liabilities and charges					
Deferred taxation	20	(1)	(7)	—	
Other provisions	21	(102)	(72)	(87)	(67)
		522	403	464	345
Capital and reserves					
Called up share capital	22	127	127	127	127
Revaluation reserve	23	145	147	139	141
Other reserves	24	9	9	9	9
Profit and loss account	25	236	116	189	68
		517	399	464	345
Minority interests		5	4	—	
		522	403	464	345

Francis Tombs
J A Rigg } Directors

March 19, 1987

The notes on pages 37 to 52 form part of these accounts

Consolidated Statement of Source and Application of Funds

For the year ended December 31st

	1986	[illegible]
	£m	[illegible]
Source of funds		
Profit before taxation	120	[illegible]
Adjustments for items not involving the movement of funds:		
Depreciation	56	[illegible]
Increase (decrease) in provisions for liabilities and charges excluding deferred taxation	30	[illegible]
Funds generated from operations	206	[illegible]
Foreign currency translation adjustments	(2)	[illegible]
Disposals of tangible fixed assets	3	[illegible]
	207	[illegible]
Application of funds		
Capital expenditure	(81)	[illegible]
(Decrease) increase in creditors falling due after more than one year	(15)	[illegible]
Tax paid	—	[illegible]
	111	[illegible]
Changes in net current assets		
(Decrease) increase in current creditors excluding corporate taxation	(14)	[illegible]
(Increase) in stocks, net of progress payments	(26)	[illegible]
(Increase) decrease in debtors excluding corporate taxation	(91)	[illegible]
Changes in net liquid assets and loans	(20)	[illegible]
Represented by:		
(Decrease) increase in cash balances	(12)	[illegible]
(Increase) decrease in bank loans, overdrafts and other borrowings:		
amounts falling due within one year	9	[illegible]
amounts falling due after more than one year	(17)	[illegible]
	(20)	[illegible]

NOTES TO THE ACCOUNTS

1. ACCOUNTING POLICIES

Basis of accounting
The accounts on pages 34 to 52 have been prepared on the historical cost basis [illegible] revaluation of land and buildings at December 31, 1985.
The Group's share of profits or losses of related companies is included in the consolidated profit and loss account. Any provisions for diminution in value of related company investments are made in the Company's profit and loss account.

Turnover and trading profit
Turnover excludes value added tax and comprises:

(i) Amounts invoiced to customers in respect of deliveries made, work completed or services rendered during the year (including any foreign exchange effect of products priced in currencies other than sterling)

(ii) Estimated sales values, where prices have not been agreed with customers

(iii) Income from licences and management fees.

Trading profit is taken at the time of sale; in the case of long-term contracts, profit is arrived at by reference to the estimated overall contract profitability.

Foreign currencies
(i) *Company accounts*
Assets and liabilities in foreign currencies are translated into sterling on the following bases:

(a) Borrowings and all intra-group balances at the exchange rates ruling at the year end.

(b) With effect from January 1, 1984, the Company designated certain foreign currency borrowings as a hedge against investments in overseas subsidiaries and consequently, from that date, these borrowings and the related overseas investments have been treated as foreign currency items. Such foreign currency borrowings were repaid during the year.

(c) Other assets and liabilities at the estimated sterling equivalent, account being taken of forward exchange contracts.

Differences on exchange, arising from the above, are charged or credited in determining profit on ordinary activities before taxation.

(ii) *Consolidated accounts*
(a) Assets and liabilities of overseas subsidiaries are translated into sterling at the exchange rates ruling at the year end.

(b) Turnover and profits or losses of overseas subsidiaries are translated at the average exchange rates for the year.

(c) On consolidation, differences on exchange arising from the retranslation of the opening net investment in subsidiary companies, and from the translation of the profits or losses of those companies at average rate, are taken to reserves.

(d) To the extent that foreign currency borrowings by the Company acted as a hedge against the net assets of overseas subsidiary companies, the differences on exchange arising from the repayment during the year of those foreign currency borrowings have been taken to reserves.

(iii) *General*
All other exchange differences are charged or credited in determining profit on ordinary activities before taxation.

NOTES TO THE ACCOUNTS

1 ACCOUNTING POLICIES (CONTINUED)

Research and development
The charge to the profit and loss account consists of total research and development expenditure less sums recoverable on development contracts, contributions by Her Majesty's Government (HMG) to shared engineering programmes and launch aid received from HMG under the provisions of the 1982 Civil Aviation Act.

Taxation
Provision is made at the rate for the year for United Kingdom corporation tax, for overseas taxation on profits of overseas subsidiaries and for deferred taxation where a liability is expected to arise in the foreseeable future.

Stocks
Stocks are valued at cost of materials, labour and relevant manufacturing overheads, less provisions for obsolete and surplus items and, where necessary, provisions to reduce cost to estimated realisable value. Progress payments received are deducted from stocks up to the limit of the relevant work in progress. Other advance payments and deposits are included in creditors.

Accounting for leases
Assets owned by third parties and finance leased from them have been capitalised at amounts equal to the original cost of the assets to the lessors and depreciation provided on the basis of Group depreciation policy. The future obligations under finance leases are included as liabilities in the balance sheet and the current year's interest element is charged to the profit and loss account.

Depreciation
(i) *Properties*
Depreciation is provided on the valuation of properties adopted at December 31, 1985 and on the original cost of purchases since 1985 and is calculated on the straight-line basis over estimated lives advised by the Group's professional valuers. Depreciation is not provided on freehold land.

The estimated lives are:

(a) Freehold buildings – 10 to 45 years (average 28 years).

(b) Leasehold land and buildings – lower of valuers' estimates or period of lease.

(ii) *Plant and Machinery, Fixtures and Fittings*
Depreciation is provided on the original cost of plant and machinery, fixtures and fittings and is calculated on the straight-line basis over estimated lives in the range 5 to 12 years.

Provisions
Provisions are made for:

(i) Likely future expenditure on warranties relating to sales up to the year end.

(ii) Anticipated losses on current contracts.

2. TURNOVER AND OPERATING PROFIT

	1986			1985		
	United Kingdom £m	Overseas £m	Total £m	United Kingdom £m	Overseas £m	Total £m
Turnover						
Civil Aero	130	627	757	79	495	574
Military Aero	220	520	740	217	525	742
Industrial and Marine	58	95	153	56	57	113
Other activities	119	33	152	105	31	136
	527	1,275	1,802	457	1,111	1,565
Geographical analysis:						
North America		497			195	
Europe		397			391	
Asia		291			235	
Australasia		44			58	
Africa		19			29	
Other countries		27			23	
		1,275			1,111	
Exports from the United Kingdom – Direct		918			712	
– Indirect		271			313	
		1,189			1,025	
Sales by overseas subsidiaries		165			170	
Parent Company sales to overseas subsidiaries		(79)			(51)	
		1,275			1,144	

	1986 £m	1985 £m
Operating profit		
Civil Aero	137	73
Military Aero	118	110
Industrial and Marine	10	28
Other activities	8	2
	273	211

Notes to the Accounts

3. Interest payable and similar charges

	1986 £m	1985 £m
Interest payable on:		
Borrowings repayable within five years otherwise than by instalments	12	14
Other loans	10	13
Finance leases	5	4
	27	31
Less interest received	6	7
	21	24

4. Profit on ordinary activities before taxation

	1986 £m	1985 £m
After charging		
Depreciation of owned tangible fixed assets	39	35
Depreciation of tangible fixed assets held under finance leases	17	15
Provision for termination charges associated with the intended disposal of an overseas facility	7	
Operating lease rentals – Hire of plant and equipment	9	10
– Hire of other assets	7	7
Auditors' remuneration (1986 £0.6m 1985 £0.6m)		
After crediting		
Rentals receivable in respect of operating leases	7	5
Profit on sale of tangible fixed assets	2	5

5. EMOLUMENTS OF DIRECTORS AND SENIOR EMPLOYEES

The emoluments of directors, charged before arriving at operating profit, were:

	1986	1985
	£	£
Fees	39,700	[illegible]
Other emoluments, including pension contributions	567,700	[illegible]
Compensation for loss of executive office	–	[illegible]

The emoluments of directors and senior employees working wholly or mainly in the United Kingdom, excluding pension contributions, were:

Chairman:		
Sir Francis Tombs	73,900	[illegible]
Sir Arnold Hall	–	[illegible]
Highest paid director	99,000	[illegible]

Directors (other than the Chairman and the highest paid director):

Emoluments £	Number	Number
Nil to 5,000	–	[illegible]
5,001 to 10,000	6	[illegible]
10,001 to 15,000	–	[illegible]
50,001 to 55,000	1	[illegible]
55,001 to 60,000	1	[illegible]
60,001 to 65,000	2	[illegible]
65,001 to 70,000	–	[illegible]
75,001 to 80,000	1	

Senior employees:

Emoluments £		
30,001 to 35,000	51	[illegible]
35,001 to 40,000	19	[illegible]
40,001 to 45,000	17	[illegible]
45,001 to 50,000	5	[illegible]
50,001 to 55,000	7	[illegible]
55,001 to 60,000	2	[illegible]

6. EMPLOYEE INFORMATION

	1986 £m	1985 £m
Group employment costs		
Wages and salaries	482	472
Social security costs	37	32
Other pension costs	40	20
	559	524

Number of employees in the Group The average weekly number of employees during the year was:	Number	Number
United Kingdom	38,800	38,400
Overseas	3,100	3,000
	41,900	41,400

7. TAXATION CREDIT (CHARGE)

	1986 £m	1985 £m
United Kingdom deferred taxation	1	(1)
Group share of related company taxation	—	1
Overseas taxation – current	(5)	(3)
– deferred	5	
	1	(3)

8. EARNINGS PER SHARE

Earnings per ordinary share of 25p each are calculated on the profit attributable to Rolls-Royce plc of £120m (1985 £77m) and on the 508 million (1985 508 million) ordinary shares in issue during the financial year.

9 Tangible fixed assets – consolidated

	Leases, buildings and short leases	Plant & machinery	Furniture & fittings	Assets in course of construction	Total
	£m	£m	£m	£m	£m
Cost or valuation:					
At January 1, 1986	189	480	8	17	694
Exchange adjustments	–	(1)	–	–	(1)
Additions at cost	7	43	1	30	81
Completed assets brought into use	2	11	–	(13)	–
Disposals	–	(8)	(1)	–	(9)
At December 31, 1986	198	525	8	34	765
Accumulated depreciation:					
At January 1, 1986	–	307	4	–	311
Exchange adjustments	–	(1)	–	–	(1)
Provided during year	8	47	1	–	56
Disposals	–	(6)	–	–	(6)
At December 31, 1986	8	347	5	–	360
Net book value at December 31, 1986	190	178	3	34	405
The net book value at December 31, 1986 includes the following amounts in respect of assets held under finance leases	–	58	–	–	58
Net book value at December 31, 1985	189	173	4	17	383
The net book value at December 31, 1985 includes the following amounts in respect of assets held under finance leases	–	66	–	–	66

The original cost of assets fully written off, but still in use and included in the consolidated figures above, amounts to £150m (1985 £131m).

Assets held for use in operating leases at December 31:	1986	1985
	£m	£m
Cost or valuation	52	58
Accumulated depreciation	(28)	(26)
Net book value	24	32

10. TANGIBLE FIXED ASSETS – COMPANY

	Land & buildings (see note 11)	Plant & machinery	Fixtures & fittings	Incomplete construction	Total
	£m	£m	£m	£m	£m
Cost or valuation:					
At January 1, 1986	174	356	5	15	550
Additions at cost	2	38	–	30	70
Completed assets brought into use	–	11	–	(11)	–
Disposals	–	(4)	–	–	(4)
At December 31, 1986	176	401	5	34	616
Accumulated depreciation:					
At January 1, 1986	–	241	3	–	244
Provided during year	6	35	–	–	41
Disposals	–	(3)	–	–	(3)
At December 31, 1986	6	273	3	–	282
Net book value at December 31, 1986	170	128	2	34	334
The net book value at December 31, 1986 includes the following amounts in respect of assets held under finance leases	–	128	2	31	161
Net book value at December 31, 1985	174	115	2	15	306
The net book value at December 31, 1985 includes the following amounts in respect of assets held under finance leases	–	56	–	13	69

Studies were conducted jointly with Turbomeca and MTU on a [illegible] engine of advanced design which could be an eventual replacement for the Gem.

Work is also proceeding on establishing the requirements and appropriate engine concepts for the next generation advanced trainer/tactical aircraft and unmanned stand-off weapons vehicles.

In the field of very high speed propulsion interest in the United States and Europe has generated for the Company a programme of studies under contract on a wide range of hypersonic cruise and transatmospheric vehicles. The Company is also engaged on preliminary propulsion work for the proposed British HOTOL (horizontal take-off and landing) vehicle. Component testing aimed at proving the concept has begun on critical technical features of the propulsion system.

Advanced engineering

Demonstration of technology before it is applied to new and improved engines has proved its value over a wide range of engines and concepts. Notable examples in 1986 included:-

- Shroudless HP turbine designs were tested on both military and civil high-pressure core demonstrators, with some work on active tip-clearance control; significant improvements in performance and weight will result.
- The high-temperature demonstrator unit (HTDU) successfully tested an advanced design of cooled turbine blade, operating at a gas temperature in excess of 2,000°K. This advance can be applied to military projects and, with sufficient operating experience, will also be used in civil engines.
- An advanced design of low-pressure turbine blade with three-dimensional aerodynamics was tested and gave a good increase in efficiency.
- A full-authority digital engine control system was demonstrated on a 535E4 engine with excellent results and forms the basis of the production [illegible] for the RB211 [illegible]

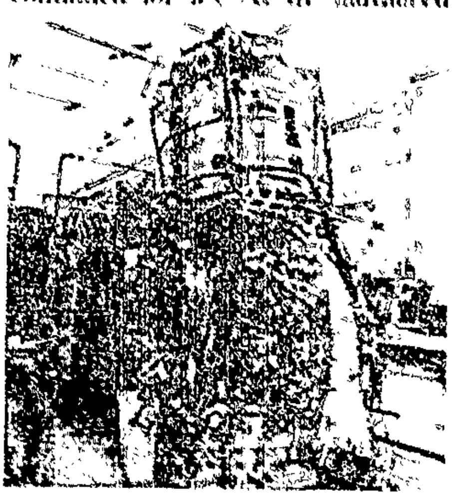
[illegible] RB211 [illegible]

The following [illegible] engines.

- The XG15 demonstration of the Pegasus 11-61 [illegible] complete engine [illegible] of the [illegible] and HP [illegible]. It demonstrated the [illegible] this new version of Pegasus [illegible] margin — an essential requirement for low cost and low risk development of the 11-61.
- The XG40 military demonstrator programme completed testing on all modules prior to incorporation into the engine programme. Testing of the high-pressure core began in March, and of the complete engine in December, demonstrating technology required for the proposed EJ200 engine.
- The advanced military engine control system (AMECS) demonstrator was released for flight testing in an RB199 engine powering a Tornado. Ground running began during the year with this demonstrator of an advanced digital control system for sophisticated military missions.

In addition, component rig testing continued for the ACME (advanced

Advanced shroudless turbine blades have been tested on the high-pressure core demonstrator



The XG15 demonstrator engine has tested technology which will give a 15 per cent increase in thrust for a proposed new version of the Pegasus engine.

core military engine demonstrator. This will validate technology for turn of the century engines, improving on the high thrust-to-weight ratio and low cost designs of XG40 and EJ200.

Research

Research programmes cover a wide range of work on many areas of engine behaviour and contribute to the technology needed to develop new engines and to improve current ones. A new gearbox testing facility was commissioned in 1986 to accommodate the large power-transmission requirements of high-bypass-ratio engines envisaged for the 1990s.

Advances in aerodynamics help to improve the efficiency of engine components. The aerodynamics of nozzle guide vanes have been advanced by the design of supercritical aerofoils. These have been tested successfully and should permit significant improvement in the performance of high-pressure turbines.

Operation at increased temperatures helps to reduce the size of engines needed to provide a given power output. A combustor intended to operate at near-stoichiometric temperatures – the highest that can be reached with conventional fuel – has been run at design conditions.

The mixing of bypass air and turbine-exit hot gas provides worthwhile improvements in performance, but also increases high-frequency noise. This challenge has now been met at research level and the solution is applicable to the Tay and -524D4D engines.

An aerodynamic concept has been tested and shows significant reduction in the skin friction of surfaces in an airstream. This has a large number of potential applications.

The development of new materials is a very important aspect of gas turbine technology. During 1986 the research programme on materials was expanded for application to all future engines. This 'materials initiative' has government support in view of its potential value to British industry.

Research work with universities in the UK and abroad continued throughout 1986. The Company is currently collaborating on around 120 projects at 26 of Britain's 47 universities. These range from large-scale research con-

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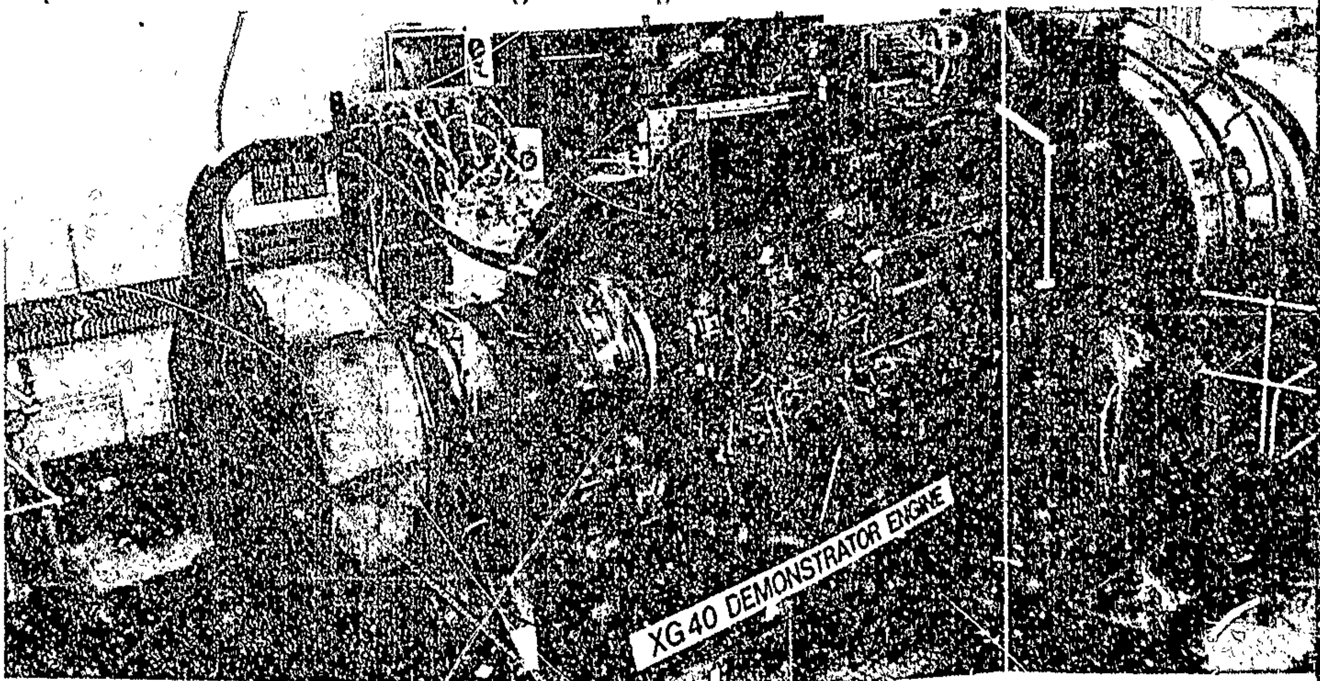

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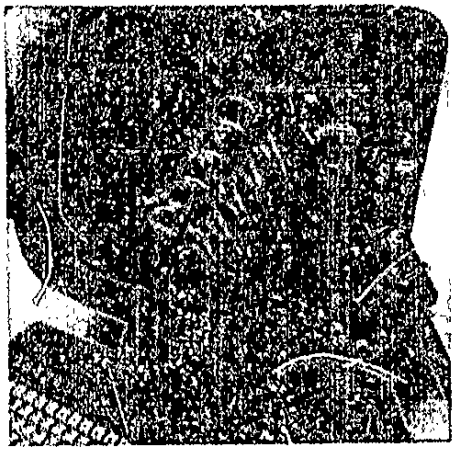


Increasing use of computer techniques speeds engine design and improves performance

racts with universities to sponsorship of postgraduate students under the Science and Engineering Research Council (SERC) Co-operative Awards in Science and Engineering (CASE) scheme. Additionally the Company funds 10 senior and research fellowships and retains 32 consultants.

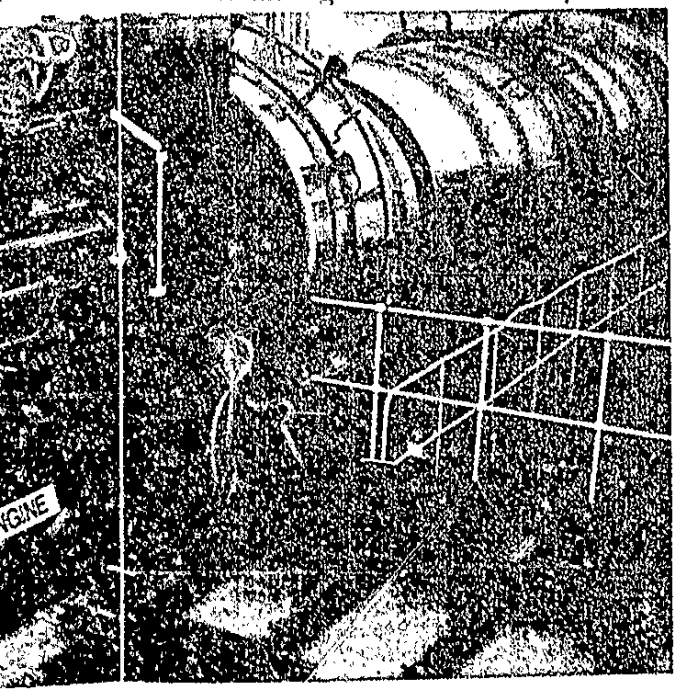
While the majority of Rolls-Royce's university research sponsorship is conducted in Britain, several projects are being carried out overseas in three academic centres in the USA and one in Australia.

The Company's research programmes continue to cover all aspects of gas turbine aero engine component performance, structures, systems, materials, manufacture and measurement techniques as well as fundamental work on aerodynamics and heat transfer. The investment during 1986 totalled £21 million including Government assistance and employed over 200 qualified engineers within the Company.

Computer-aided engineering and manufacturing

The effective application of the latest technology to Rolls-Royce products now depends substantially on technical computing systems. During the year the investment in computers and systems design was increased. Organisational and technical changes have continued in order to introduce integrated systems which cover technical computation, geometry definition, manufacturing engineering and automated test recording and analysis.

The benefits of technical computing systems have been demonstrated by advances made with the most difficult engine component – the cooled high-pressure turbine blade. As a result recent new designs have provided higher performance and reduced modification and warranty costs, as well as consistently high blade lives. Computerised design techniques providing similar advantages are being applied progressively to all key components of engines.



Business group support

Corporate Engineering is responsible for the design definition of all Company products for manufacture. Emphasis placed on quality and speed of design, including the thousands of technical calculations involved, has led increasingly to "right first time" design and corresponding reductions in the time and cost of development. This is further enhanced by the Company's policy of proving new technology before designs are finalised and the concentration on common advanced parts between engine designs.

Advanced engine components save fuel; these cooled nozzle guide vanes were designed using 3D flow techniques

Supply Group

Manufacture of wide-chord fan blades at Barnoldswick

The Supply Group is responsible for providing engine components needed by the Company for its business groups and Corporate Engineering. It employs some 16 500 people and is responsible for the Company's manufacturing facilities and for external component procurement.

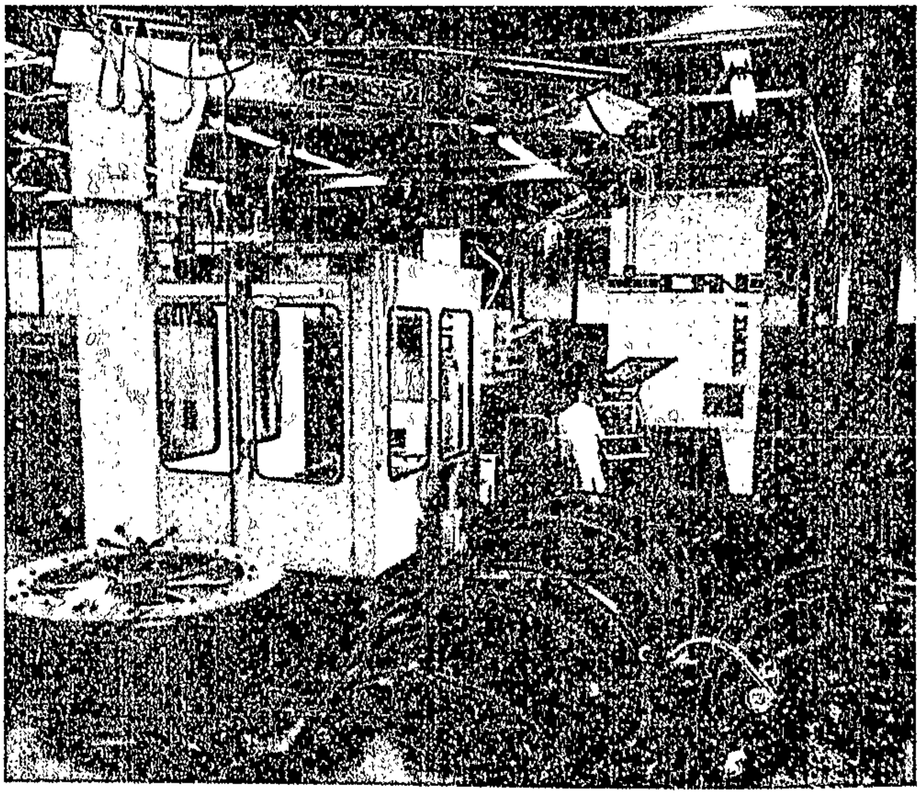
During 1986, the Supply Group responded effectively to the continued growth in demand for components from the business groups.

Employment rose by some 500 people during the year – with most recruitment in the Derby factories – in order to increase manufacturing capacity and to strengthen manufacturing engineering and technology capability. Productivity continued to improve, building on the gains of recent years.

Strategic plans are being established for each type of component selected for internal manufacture. The phased introduction of new automated manufacturing cells continued in 1986 and the major improvements achieved earlier by the [illegible] of new manufacturing concepts have been consolidated. Computer modelling of new automated cells is being used to optimise their design and minimise capital cost.

At the Hucknall factory manufacturing cells are being commissioned for the production of large fabrications and a flow line for manufacture of Tay jetpipes was also completed. It has a number of cells which together cover the whole production cycle.

The Alfreton Road factory at Derby produces a range of composite structures, including the bypass duct for the Tay, which is produced in carbon fibre composite. Automated manufacture has been introduced to meet the high output levels required by the success of the Tay. Six automated cells have been designed and installed for bypass-duct manufacture; all use the latest technology for material processing, automatic handling and robotics.



Production of Tay bypass ducts in carbon-fibre composite, using computer control, at the Company's Alfreton Road, Derby facility

In Derby the second Hann Blohm line for the automated creep feed grinding of turbine blades was fully commissioned, it is producing turbine blades for RB199 engines.

The advanced integrated manufacturing system (AIMS) at Derby was in full operation throughout 1986 for machining a wide range of turbine and compressor discs. Opened by the Prime Minister, the Right Honourable Mrs Margaret Thatcher MP, in January 1986, this plant is an integrated grouping of versatile machine and process cells directed by a computer-ed central control system. Robot trucl transport parts around the facility.

At Bristol an automated line for the machining of nozzle guide vanes was introduced in 1986, it incorporates technology originally demonstrated at Derby on robot-controlled lines for grinding turbine blades. This advance follows the installation in 1985 of the automated 360° electro-chemical machining system for compressor blades.

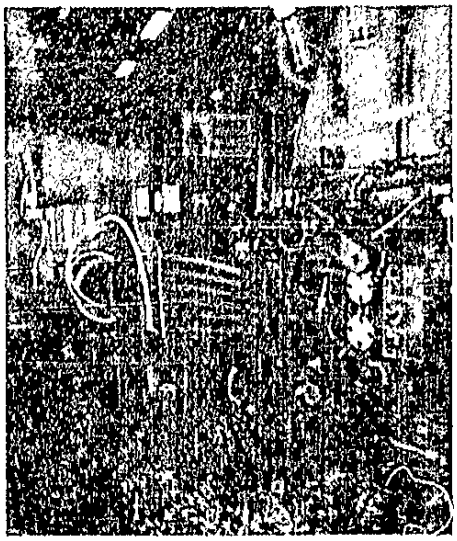
The Bristol line for nozzle guide vanes illustrates the Supply Group's strategy for new manufacturing technology. The technical advances in manufacturing which provide real improvements in productivity and quality are being applied across manufacturing facilities and, where possible, the same advanced equipment is used. This approach avoids duplication of effort and optimises the use of manufacturing engineering resources.

The performance of the Company's network of suppliers is critical to the achievement of its business objectives. Close links are maintained with suppliers – both in Britain and abroad – to encourage a high level of supplier performance and efficiency.

The Company has a leading position in advanced-manufacturing technology development and ensures that suppliers are involved at an early stage of the component design process, both through individual contacts and supplier conferences. They are encouraged to invest in advanced equipment, improve their efficiency, and reduce lead times and inventory levels.

There is high priority for development of new processes and materials to achieve product quality through close control of the manufacturing process rather than by costly inspection of parts. During 1986 work continued to ensure that components can be made more economically and effectively through close links between the Supply and Engineering Groups. These developments are key to further reductions in lead times and improvements in the cost effectiveness of engine components.

Further improvements in the cost



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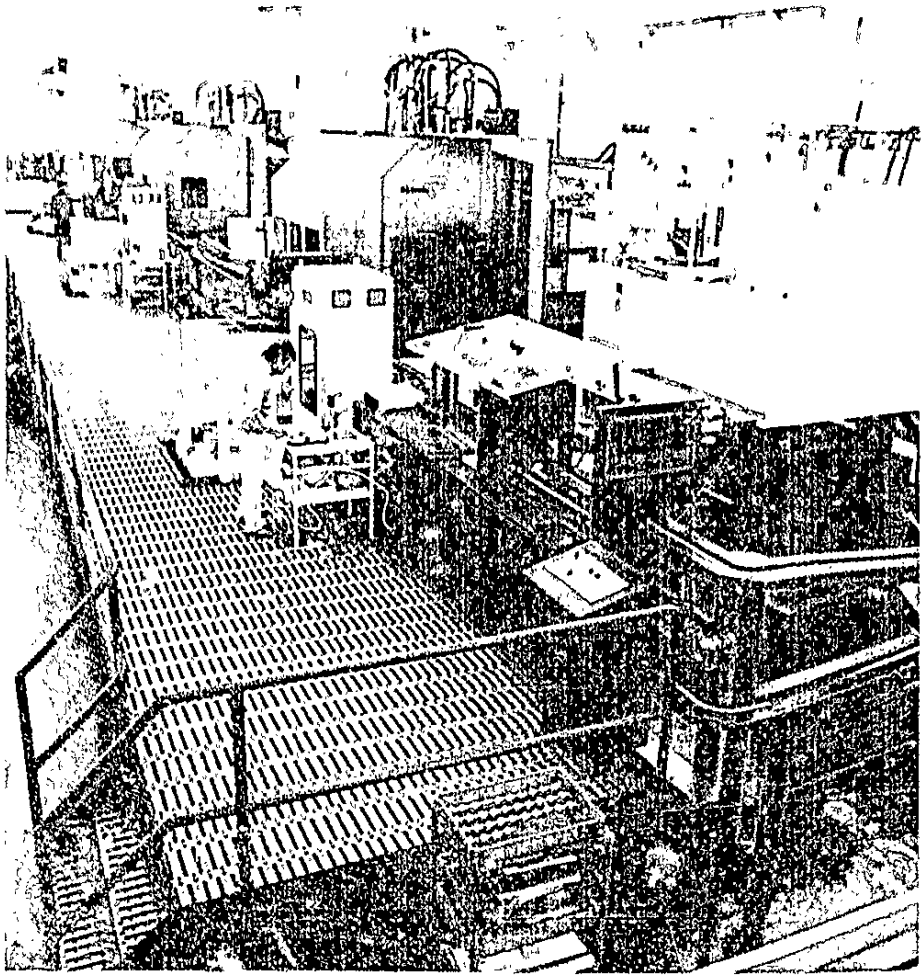

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Rolls-Royce and Associates Limited made good progress in 1986 with the prototype of the advanced propulsion system which will power the next generation of Royal Navy submarines. In 1985 this prototype was moved from Barrow to the new test facility at Dounreay, which was officially opened by HRH The Duke of Edinburgh on 25 July.

Major engineering components were delivered ahead of schedule from Vickers Shipbuilding and Engineering in October and work continues on programme including operator training and preparations for final commissioning in 1987.

The company provides support for the Royal Navy in the maintenance and refuelling of operational nuclear-powered submarines. It has developed a new technique for decontamination and consequent radiation-dose reduction in refuelling. This was demonstrated on the first submarine prototype at Dounreay and applied to the refuelling of HMS Valiant at Rosyth in August. It gives substantial savings in overhaul and maintenance times and will be used for all future refuelling operations.

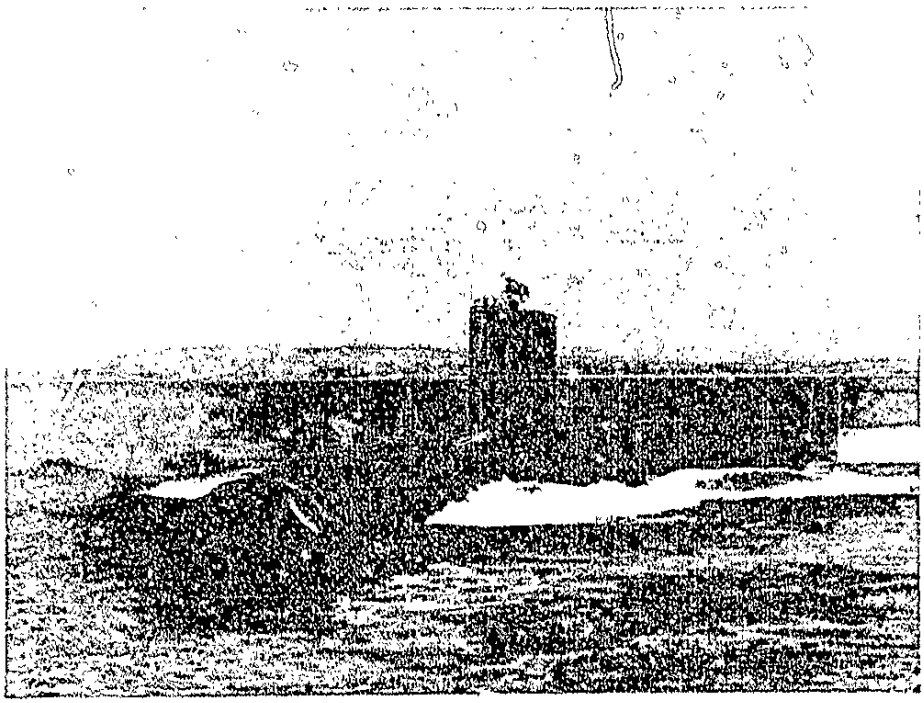
The sixteenth Fleet submarine, HMS Torbay, was commissioned in February 1987. The next boat in the Trafalgar class, HMS Trenchant, was launched in November and the two remaining submarines of this class are being built, as is the first Trident submarine, HMS Vanguard.

Since 1981 Rolls-Royce and Associates has diversified its business activities by offering consultancy and support services to the nuclear industry as a whole.

The company is bidding for work in support of civil nuclear power station programmes and a contract has been won from the Central Electricity Generating Board to examine materials in the harsh environment which might follow a reactor accident. Bids have been submitted for further development of this work.

The company has completed its current planned expansion and consolidation for the naval nuclear programme and the application of its technology to other engineering projects.

HRH The Duke of Edinburgh opened the new Dounreay test facility in July. He is pictured here with Commander Paul Thomas (right), Naval Superintendent, Vulcan Naval Reactor Test Establishment



HMS Torbay, the sixteenth of the Royal Navy's nuclear-powered Fleet submarines

Engine strip inspection lines at the Company's East Kilbride facility in Scotland

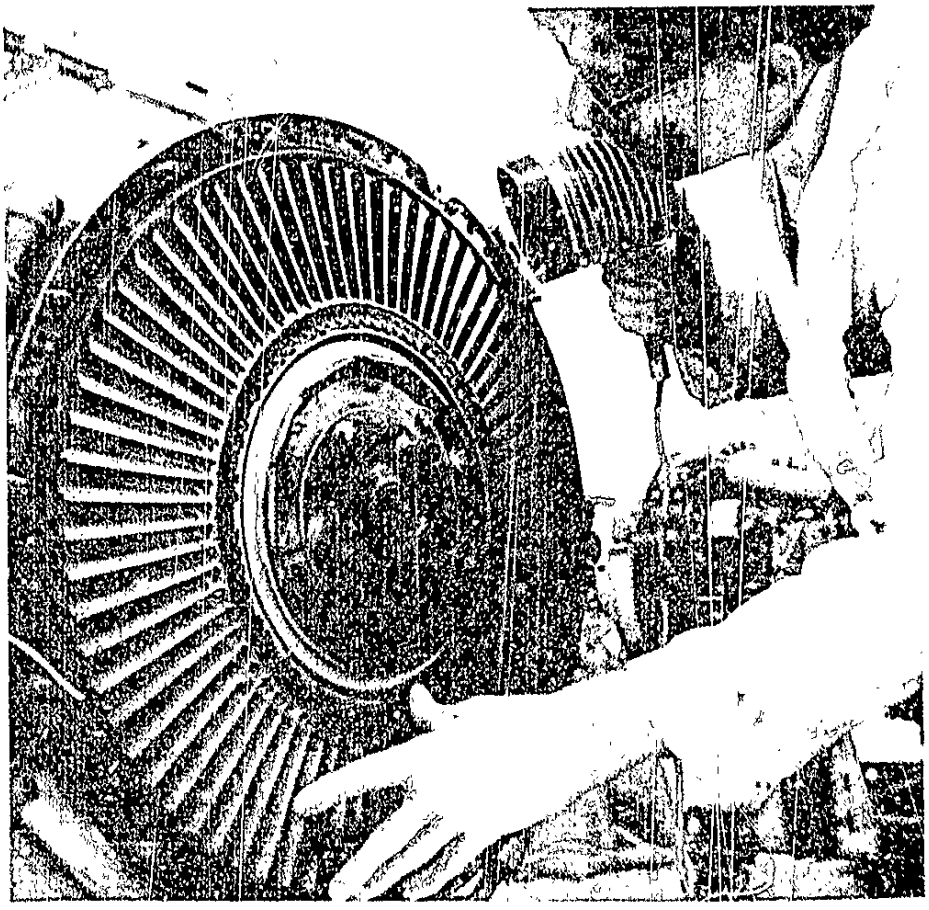
There was increased activity in Pesetas with business for the Repair and Overhaul group. Mid-year work declined slightly but this was more than offset by the increased civil business. Strong competition continued for constant price but the group made a significant contribution to Company turnover. Commercial and technical activities are being strengthened to improve service to customers.

The Company won the British Ministry of Defence competitions for work on Gnome and Pegasus engines; this work will be undertaken at Leavesden and Bristol respectively.

Eastern Air Lines placed a contract for support of its 535E4 engines; modules will be returned to Derby for overhaul and engines will be tested in the new Montreal test cell commissioned in the year under review by Rolls-Royce (Canada) Limited. East Kilbride continued to ease the capacity strain of the Dart and Spey repair and overhaul markets.

Preparations are well advanced at East Kilbride and Montreal to provide support for the Tay engines of Gulfstream IV and Fokker 100 aircraft. Deliveries of overhauled fuel pressurising modules for General Electric CF34 engines have begun from East Kilbride under a contract with the US Air Force.

New equipment is being installed to increase revenue from the repair of engine components. Numerically controlled machine tools and advanced welding sets are being installed in Britain and Canada and a facility to repair nozzle guide vanes by activated diffusion brazing is being established at East Kilbride.



Full scale production of the Dart turboprop ended in 1986, just before the 40th anniversary of its first run. However, this engine will continue to generate revenue through repair and overhaul and spares sales for years to come

Personnel and Employee Involvement

The Company continues to foster an environment in which employees become involved in and committed to the business. This has been particularly important in 1986 as the Company prepares to return to the private sector.

Communication

Across the Company there exist various forms of communication, each adapted to the particular needs of individual sites.

Once a year a direct brief is provided for all employees in the form of a video presentation on the Company's performance, the contributions of operational units and prospects for the future. This is followed by a question-and-answer session. From time to time the same technique is used to ensure that employees are made aware of important issues affecting the Company.

These activities are complemented by more frequent localised programmes of communication. They take the form of regular briefing groups, departmental news sheets and announcements via loudspeaker systems or notice boards.

Rolls-Royce News, the Company's monthly internal newspaper, regularly reports items of both corporate and local interest.

In preparation for the return to the private sector Privatisation Bulletins have been distributed to UK employees, both to explain key issues and to respond to questions raised by employees.

Consultation

The Company continues its commitment to consultation with employees and their trade union representatives on a comprehensive range of topics related to its overall business objectives. Joint committees of management and employee representatives meet regularly at every site to discuss problems and opportunities, share ideas and reconcile viewpoints.

In 1986 Rolls-Royce again held a central forum which was attended by the most senior members of management and representatives of Staff and Works unions from all sites. This forum has been developed over the years and is recognised as an important and valuable date in the Company's calendar.

Manpower

After significant restructuring over a number of years and consolidation of the organisation established at the end of 1983, the Company is well placed for the future.

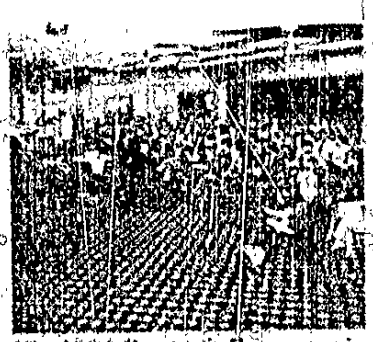
The overall levels of manpower rose marginally during 1986. While employee turnover is lower than in the engineering industry generally, it is necessary to replace those who leave or retire. Various campaigns to attract appropriate skills into the business took place with generally satisfactory results and the Company has maintained its good image in the recruitment market.

The changing face of manufacturing industry, with the associated introduction of new technology, emphasises the need to retrain and redeploy people wherever possible. The Company actively pursues this policy.

Amenities

Employees are actively encouraged to join the various welfare and sporting associations open to them and their families at the different sites.

Families have also had the opportunity to visit many of the factories on open days. These are popular occasions and will remain a regular feature of Company policy.



The 1986 Company Forum again provided a useful platform for discussion between management and unions from all sites

Open Day at Hucknall attracted thousands of visitors – family members and friends of employees

UK Locations and Numbers Employed at December 31, 1986

Dounreay	466
Hillington	2,724
East Kilbride	2,423
Sunderland	506
Barnoldswick	1,328
Deeside	116
Hucknall	981
Derby	14,404
Mountsorrel	587
Coventry	2,392
Ansty	2,024
Leavesden	2,260
Bristol	8,730
London	48
Total	38,992

Pension Fund

The Rolls-Royce Pension Fund was formed by the combination of the Staff and Works Pension Funds in April 1986. The Pension Fund is an exempt approved scheme which is self administered and is contracted out of the State Earnings Related Pension Scheme. Membership of the Pension Fund is a condition of employment for all new employees of the Company, Rolls-Royce and Associates and Sawley Packaging Company aged 16 or over and under 61 (men) and 59 (women).

The Chairman of the Trustees of the Pension Fund and up to eight other trustees are appointed by the Company and eight trustees are elected by the contributing members of the Fund. The investment of the Fund is delegated to outside specialist investment managers and the administration and custody of the assets is undertaken by a global master custodian.

In 1986 the Company approved increases in the overall benefits provided by the Fund as well as cost of living increases to pensioners.

Separate schemes are provided for employees of overseas subsidiary companies and Deeside Titanium Limited.

Education and Training

The Company continues its investment in cost-effective training that is relevant to and supportive of current and future business requirements.

By the end of 1986 12,000 adult employees had attended further education and training programmes to enable them to improve performance in their jobs and to prepare them for their future careers. Many of the programmes were new and were developed in support of investments in new technology, most with a heavy computing emphasis or aimed at the key activities of the business.

During 1986 the Company took part in many education and training initiatives. In addition to opening its training centres to the public for Industry Year, well over 50 schools throughout the country were visited and there was an increased number of teacher visits from local schools and colleges.

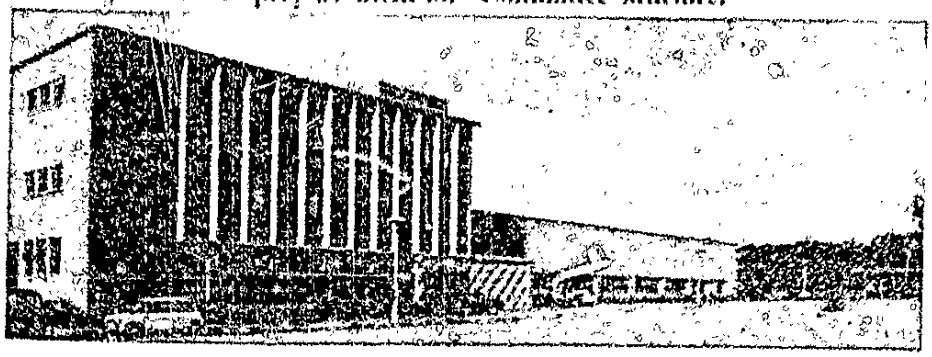
1986 saw the launch of the Manpower Services Commission's two-year YTS initiative. In addition to recruiting over 500 school, college and university leavers, Rolls-Royce had over 100 people in two-year YTS programmes. This has brought its current total of full-time trainees to well over 1,200.

1986 also saw the launch of Open Learning facilities at some Company locations. These facilities have computing as their emphasis and provide an opportunity for employees to enhance their skills and education at a pace and time suitable to the individual.

Health and Safety

In 1986 industrial accidents remained at a level well below the average for similar UK manufacturing industry.

The Company has a continuing programme to assess potential health hazards; this is supported where necessary by environmental measurement. Involvement of the workforce in health and safety issues is encouraged through safety representatives and the Safety Committee structure.



The Company's facility at Michi

Overseas Activities

New large engine test cell at Rolls-Royce (Canada) Limited, Montreal

In recent years more than 70 per cent of Rolls Royce sales have been made directly or indirectly overseas. To support this business, the Company has an extensive overseas network, with over 250 service representatives located at airlines, armed forces and repair bases in more than 30 countries.

The Company also has important facilities in Canada for the repair and overhaul of engines; the manufacture of industrial gas turbines and nuclear, aero engine and aircraft components; the assembly of rocket motors and the manufacture of propellants for rocket motors. In the USA there is an engineering facility and in Brazil there are facilities for the repair and overhaul of engines and the manufacture of engine components.

In addition there are subsidiaries in nine other countries, mainly covering marketing and product support operations.

United States

North America is a major market for the Company's civil and military gas turbines. Rolls Royce supports this important market through its subsidiary Rolls-Royce Inc, which has its headquarters at Greenwich, Connecticut.

Atlanta is the base for the product support which the company provides for airline and executive and corporate operators in North and Central America, Mexico and the Caribbean. Customers in this area use seven types of Rolls Royce engine in 19 different aircraft types. More than 2,600 engines are currently in service.

Since the US Department of Defense is one of the Company's most important customers, Rolls-Royce maintains a local marketing and field service-support organisation in Washington, DC.

The Company has extensive military business with the US Marine Corps for the V/STOL, and the US Navy and the US Air Force for the A-7 Corsair and C-20. Full-scale development and planning for the US Navy F-15 Goshawk programme has begun. There are also new business opportunities in areas such as component manufacture and repair. Local Rolls-Royce Inc representation has therefore been established in Dayton, Oklahoma City, Philadelphia and San Antonio. These locations represent key US Air Force and US Navy procurement centres.

Rolls-Royce Inc's engineering group at Atlanta has strengthened the position of Rolls-Royce in the US research and development field. It carries out work on behalf of the US Air Force, US Navy, Federal Aviation Administration (FAA) and the National Aeronautic and Space Administration (NASA). Research contracts include studies of

Rolls-Royce product support engineer with Eastern Air Lines personnel

Report of the Directors

Principal activities
The Company's principal business is the design, development, manufacture, sale and support of gas turbine engines and ancillary equipment for aircraft and for industrial and marine applications.

Its subsidiary companies include Rolls-Royce and Associates Limited which designs, develops, procures and supports nuclear steam raising plant for naval purposes. Other subsidiary companies are mainly involved in the manufacture of aerospace and related products and in providing sales and service support of the Company's products overseas.

Results for the year
Turnover for the year was £1,802m (1985 £1,601m), including direct exports of £918m (1985 £712m).

Profit before taxation was £120m (1985 £81m). The directors do not recommend the payment of a dividend and the net profit of £120m (1985 £77m) has been retained.

A review of the year's operations, research and development activities and future prospects is contained in the Chairman's Statement and in the Review of Activities.

Fixed assets
Expenditure on fixed assets during the year amounted to £81m (1985 £48m), mainly in respect of gas turbine manufacturing and engineering facilities and supporting computer equipment.

The professional valuation of the Company's land and buildings at December 31, 1985 has been updated to the end of 1986 and suggests a value of £7m greater than the figure shown in the accounts.

Re-registration
On May 1, 1986 the Company re-registered as a public limited company and adopted new Articles of Association.

Employees
The number of Group employees at the end of the year was 12,098 (1985 11,700).

Employee involvement
Company policy on employee involvement is outlined on pages 20-21.

Disabled persons
The Company's policy continues to be to provide, wherever possible, employment opportunities for disabled people, to look after employees who become disabled and to make the best possible use of their skills and potential.

Donations
No political donations were made by the Company or its subsidiaries. Charitable donations amounted to £15,300 (1985 £13,500).

Directors
The directors listed on pages 1-5 were in office throughout 1986 apart from Sir Robin Nicholson, appointed April 1, 1986.

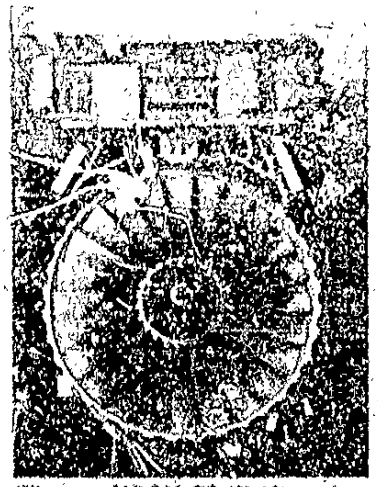
Mr S. L. Higginbottom resigned from the Board on November 30, 1986.

None of the directors of the Company at December 31, 1986 had, during the year, any interests in the shares or debentures of the Company or any of its subsidiaries.

Auditors
A resolution to re-appoint the auditors, Coopers & Lybrand, will be proposed at the Annual General Meeting.

By order of the Board

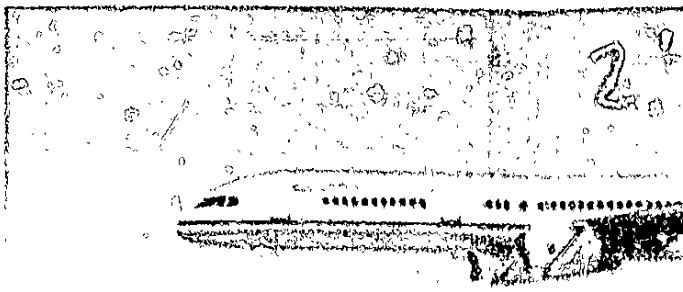
Anthony Warrington
Secretary
March 19, 1987



The new RB211-524D4D engine, pictured here on test at Derby, provides 58,000 lb take-off thrust and outstanding fuel economy

Rolls-Royce is prompt to respond to engines which power military transport aircraft and executive and corporate types. During the year significant orders were received for the RB211-524, the -535, the IAE V2500 and the Tay. Spares revenue was buoyant.

The demand for new civil aircraft and engines remained at a high level during 1986. Fuel prices have remained at relatively low levels, delaying the need to replace older and less fuel efficient aircraft.



RB211-524

The RB211-524 is in service in the Boeing 747 and Lockheed L1011 TriStar aircraft and during 1986 further orders were received for engines and conversion kits valued at over £500 million.

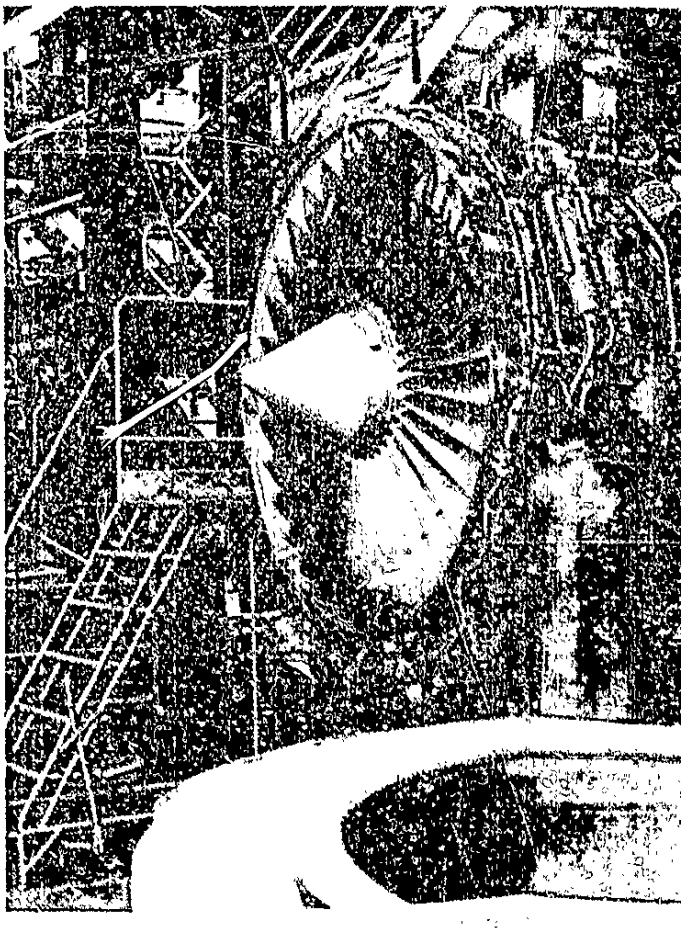
During the year, the latest engine mark, the -524D4D, was launched with orders from Cathay Pacific and British Airways for two and sixteen 747-400 aircraft respectively.

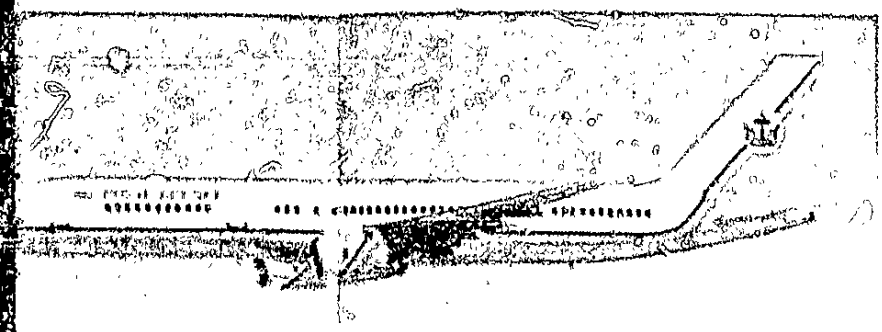
The -524D4D is due for certification in 1988, with entry into service in 1989. It will produce 58,000 lb of thrust – with the potential also to power twins and trijets – and more than nine per cent improvement in fuel economy over the basic -524D4 standard, ensuring that a Rolls-Royce engine remains the most fuel-efficient option on the 747 aircraft.

The engine features Rolls-Royce's unique wide-chord fan and integrated exhaust nozzle and also incorporates advanced component design and an electronic fuel control system.

Because of the modular design of the RB211, airlines can incorporate into their earlier -524 engines many of the advances which provide the D4D's 58,000 lb take-off thrust and excellent fuel economy. This ability to upgrade RB211-524 engines to take advantage of the latest developments is specific to Rolls-Royce's derivative approach and, potentially, of significant economic benefit to airlines. The D4D made its first test run in January 1987, ahead of schedule, and subsequently achieved its declared thrust rating.

Following the announcement that Rolls-Royce and General Electric of the USA will cease revenue sharing on the CF6-80C2 and the 535E4 engines, the use of the RB211-524D4D and its derivatives is being evaluated for other aircraft applications.





nouncement that
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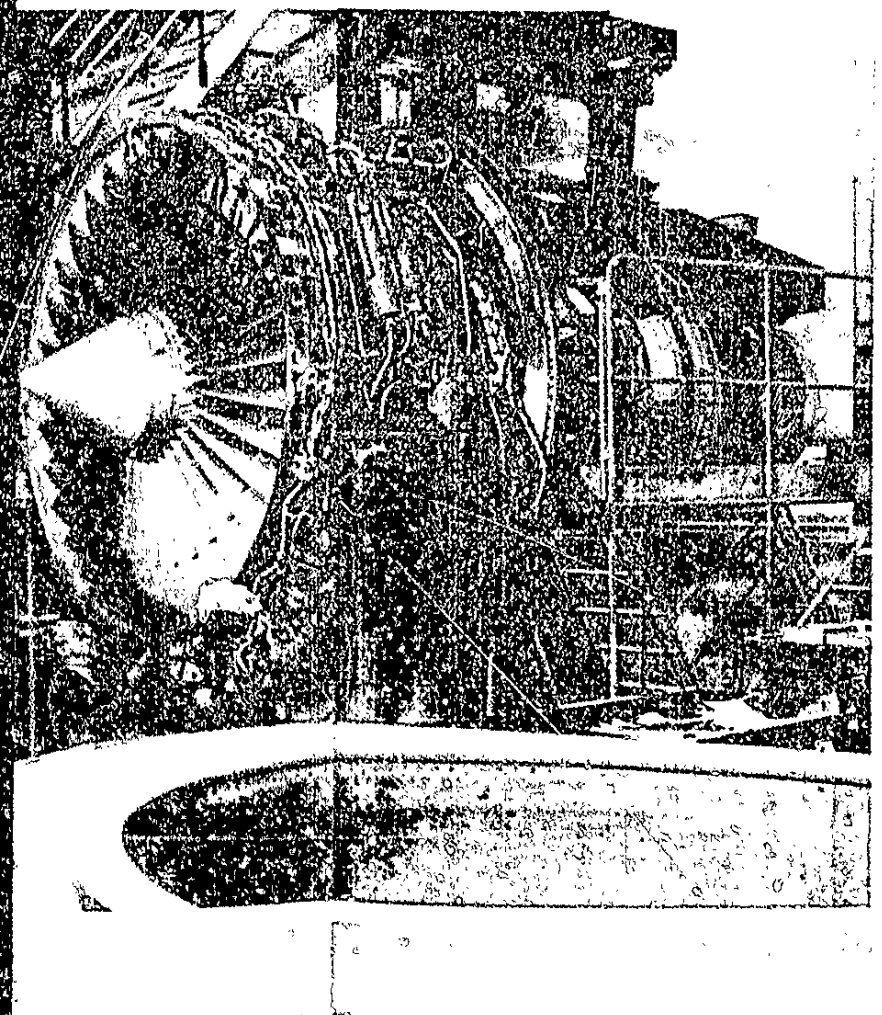
535

The 535C was developed for the Boeing 757 airliner as a 37,400 lb thrust engine based on the core of the larger RB211-22B engine which powers Lockheed TriStar wide bodied airliners.



The 535 [illegible] Boeing [illegible] million hours of operating [illegible] with Eastern Airlines, British Airways, Monarch Airlines, Air Europe and [illegible]

The 535E4 version was developed to provide better levels of fuel consumption for the Boeing 757 than the 535C, as well as maintaining thrust. It is the most advanced of the Company's civil engines now in service and incorporates a range of light technology improvements developed by Rolls-Royce, including its high performance wide chord fan.

The 535E4 entered service in October 1984 to power the Boeing 757s operated by Eastern Airlines. It has also operated by Monarch Airlines, Royal Brunei Airlines and Northwest Airlines. Northwest completed its first year of 535E4 operation on December 16 without any engine removal or in-flight shutdown. The performance of the engine was described as "outstanding" by the airline's president.

There were further orders for the 535E4 during 1986 from Royal Nepal Airlines, Air 2000, International Lease Finance Corporation and El Al. These orders were won in the face of strong competition and by the end of the year 12 out of 17 Boeing 757 customers had selected the 535, demonstrating the appeal of this engine's exceptional reliability and attractive overall cost of ownership.

At the end of 1986 airworthiness approval was received for the 535E4 to be used for extended-range operations with the Boeing 757 and it is the only powerplant currently available for such operations with this twin engined aircraft. This approval has been given as the result of the engine's excellent reliability in a quarter of a million hours of airline service such as the 535E4 fleet use on long distance 757 flights over water and remote areas.

Royal Brunei [illegible] services with [illegible] Boeing 757s in [illegible]

Final assembly of [illegible] 535E4 [illegible] Derby production [illegible]

V2500

Rolls-Royce has a 30 per cent share-holding in IAE International Aero Engines AG, the five-nation consortium producing the 25,000lb thrust V2500 turbofan. Other participants are Pratt & Whitney through its parent United Technologies Corporation, also with 30 per cent, and the remaining 40 per cent of the shares are held by the Japanese Aero Engines Corporation (JAEC), MTU of West Germany, and the Italian company Fiat Aviazione.

Significant progress was made during 1986 towards certification of the V2500, which is scheduled for April 1988. Eight development engines had joined the test programme by the end of the year. The V2500 is programmed to enter service in the Airbus A320 airliner in April 1989.

The engine maintained its position during 1986 as the leading powerplant for the A320 with Royal Jordanian becoming the seventh V2500 customer in September. By the end of 1986, the V2500 had been selected for some 60 per cent of the engine business for the A320 aircraft on order or option, covering some 370 engines. IAE is negotiating for further V2500 orders with airlines which have selected the A320 aircraft and is actively pursuing other applications for the engine, both civil and military.

Five-nation V2500 engine being prepared for a test run

Tay

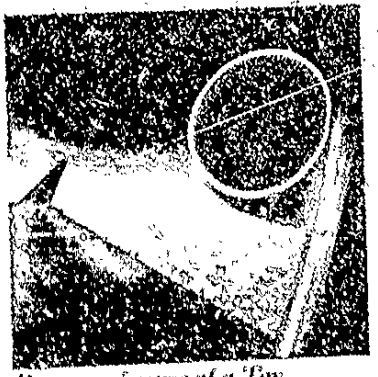
A highlight of the year was the airworthiness approval of the Tay engine by the Civil Aviation Authority and Federal Aviation Administration for both the new Gulfstream IV executive jet and the new Fokker 100 airliner. This was achieved on schedule after one of the smoothest development programmes ever conducted by Rolls-Royce. The Tay met or exceeded all of its design requirements and production deliveries of the engine began in November.

The Gulfstream IV made its first flight in September 1985 and is expected to receive its flight certificate of airworthiness during the early months of 1987. By the end of 1986 over 100 Gulfstream IV aircraft had been ordered.

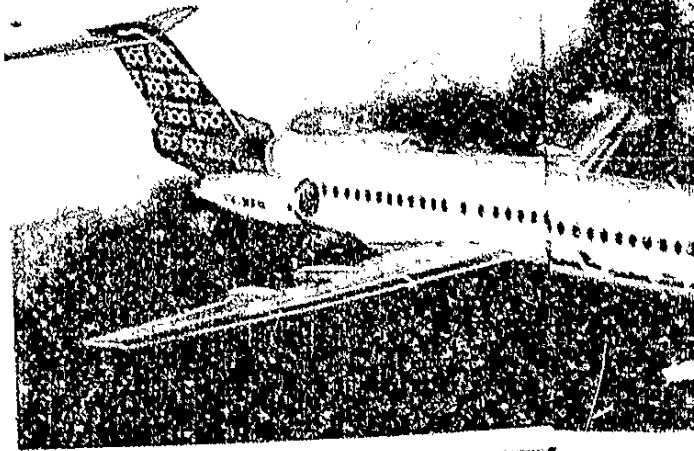
The prototype Fokker 100 made its first flight on November 30. It is scheduled for certification in October 1987, with first deliveries of production aircraft to Swissair planned to start soon after.

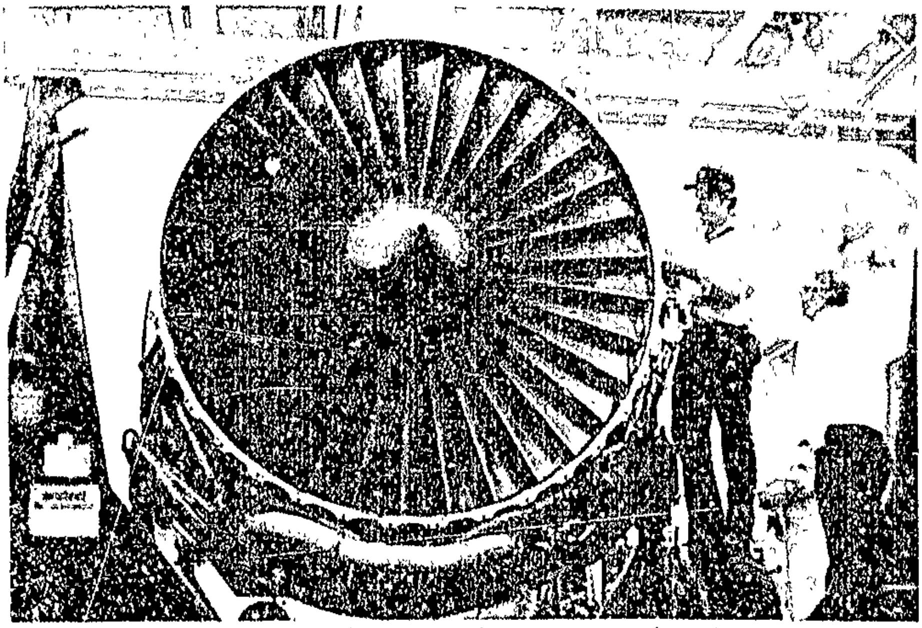
In 1986 this advanced aircraft, already selected by Swissair, KLM and USAir, was also chosen by two more customers – International Lease Finance Corporation (ILFC) and a new joint-venture company, GPA Fokker 100 Limited.

The design of an uprated version of the Tay, the Mk 650, which will give just over 15,500 lb thrust for take-off was completed during 1986. The first



Passenger's view of a Tay turbofan powering the Gulfstream IV executive jet





During 1986, Delta Air Lines began engineering work at their Atlanta, Georgia facility to upgrade RB211-524B4 engines as part of a programme to provide increased payload/range for their TriStar L1011 fleet

development engine made its initial test run on schedule in December. This higher-thrust Tay will power the Fokker 100 aircraft chosen by USAir and GPA Fokker 100 Limited.

By the end of 1986 orders and options for the Fokker 100 stood at 180, with firm business for the Tay exceeding £600 million in total.

Dart and Spey

The last Dart turboprop was delivered in 1986, just before the 40th anniversary of the engine's first run in July 1946. Since production deliveries began, more than 7,000 Darts have been made and over 1,000 remain in service, making it one of the Company's most successful civil engine programmes.

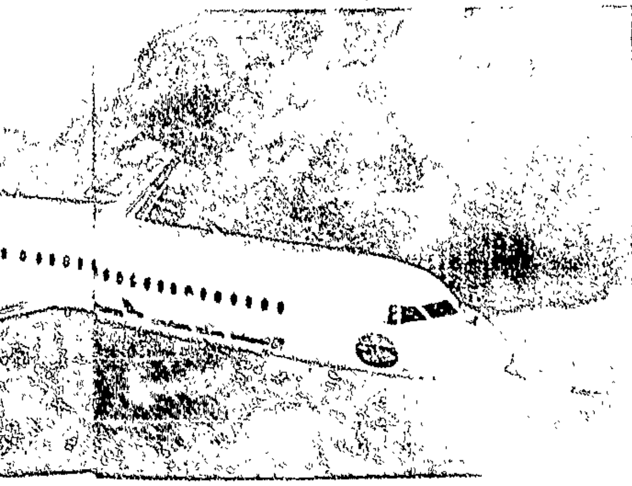
Some Darts produced 25 years ago remain operational after more than 65,000 flights and business produced by this engine for Rolls-Royce now stands at over £2.5 billion (at 1986 prices).

It is anticipated that Darts will go on generating considerable spares business well into the next century.

The year also saw the completion of civil Spey production. Fifty Spey turbofans were delivered in 1986 for Gulfstream III and Fokker F28 aircraft. Over 5,100 Speys have been produced for civil and military applications.

New projects

Work on the technology for new civil engines is described in the Corporate Engineering section (pages 20-23). These engines include advanced turboprops, propfans and the large high-bypass engines likely to be needed for the medium and long range aircraft which the Company believes will form at least half the total market for new engines by [illegible]



The maiden flight of the Tay-powered Fokker 100 took place on November 30

This business group is responsible for a wide range of engines for military aircraft, military and civil helicopters, missiles and for the Concorde supersonic airliner. There are more than 11,000 Rolls-Royce military aero engines in service with over 110 armed forces throughout the world.

RB199

The Turbo-Union RB199 engine accounts for a major part of the Company's current military business. It was developed and is being produced jointly by a consortium of Rolls-Royce, MTU of West Germany and Fiat Aviazione of Italy to power the three-nation Panavia Tornado aircraft.

More than 550 Tornado aircraft are now operated by the Royal Air Force (RAF) and the German and Italian Services and the Royal Saudi Air Force. RB199 engines now have more than half a million hours of service experience.

The latest version of the engine, the Mk104 with extended reheat, entered service in August 1986 powering Tornado ADV (air defence variant) aircraft of the Royal Air Force.

RB199 Mk101 engines are also installed in the British Aerospace Experimental Aircraft Programme (EAP) demonstrator, which first flew in August. This important aircraft project is demonstrating technology advances for incorporation in the proposed new European Fighter Aircraft (EFA) which is to be designed as a single-seat, twin-engined, agile fighter planned to enter service in the mid-1990s.

The first phase of the EAP flight-test programme was completed in 1986 and the RB199 performed impeccably, allowing maximum time to be devoted to airframe evaluation.

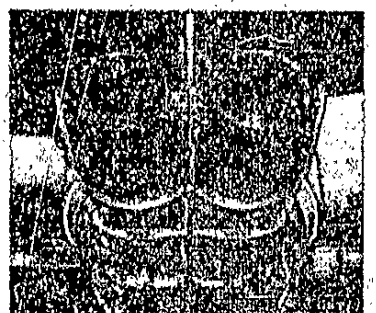
Deliveries of the 72 Tornado aircraft ordered by Saudi Arabia began in 1986. This export order increased total orders for the RB199 to more than 2,300 engines.

The NATO Multi-role Combat Aircraft Management Agency (NAMMA) placed its seventh order for engines in 1986. By the end of the year over 1,000 RB199 engines had been delivered by the consortium companies.

Pegasus

The Pegasus is a unique engine developed for V/STOL combat aircraft, and in particular for the Harrier and AV-8 series of aircraft. Over 670 Pegasus engines have been delivered (including development engines) and over 110 are in service with the RAF, Royal Navy, US Marine Corps and Spanish and Indian Navies. Sales increased considerably in 1984 and 1985 and have continued at a high level through 1986, mainly due to the increase in deliveries to the US Government. Major programme events during 1986 were the deliveries of the engine for the McDonnell Douglas LAV-8B trainer version of the Harrier II, which was rolled out in November, and deliveries of the first engines equipped with the digital engine control system.

As the only successful engine of its kind, and as a result of the considerable versatility it confers on the aircraft, continued export sales are anticipated. The existing production programme is planned to continue until 1993.



Two of the latest RB199 turbofans together provide 32,000lb of reheated take-off thrust for the three-nation Tornado

An uprating programme is in hand to provide a 10 per cent increase in vertical lift thrust. Down-rated version of the engine, the Pegasus 11-61, offering substantial improvements in aircraft performance and a reduction in engine operating costs.

Adour

Initially developed jointly by Rolls-Royce and Turbomeca for the Anglo-French Jaguar, the re-heated Adour turbofan also powers the Japanese T-2 and F-1 aircraft. The Adour engine without re-heat is installed in the British Aerospace Hawk trainer. Adour engines have accumulated more than 2 million hours of service experience.

The engine has been selected to power the McDonnell Douglas T-45 Goshawk which is a derivative of the British Aerospace Hawk for the U.S. Navy advanced jet trainer programme. Has aircraft is in its full development programme and the U.S. Navy's requirement for Goshawks has been projected at over 300.

The new Mk871 version of the Adour is under development for the single seat Hawk 200 fighter ground-attack aircraft. It is designed to offer [illegible]

Spey

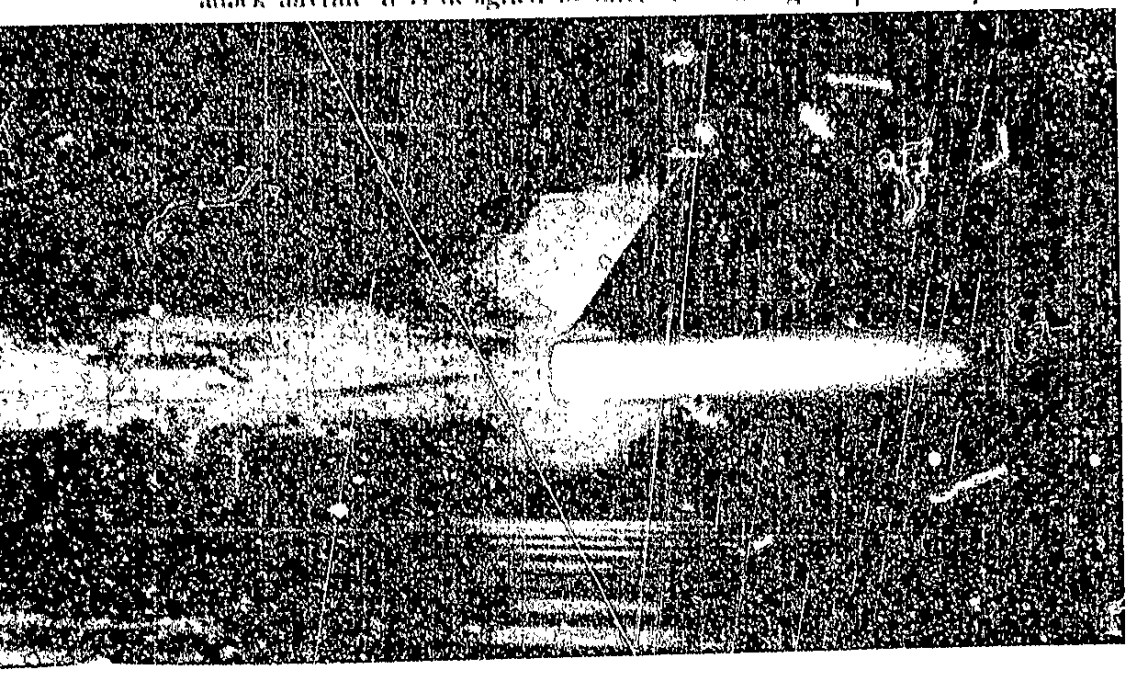
The Company continues to develop the military Spey Mk 807 for the Italian-Brazilian AMX light combat aircraft planned to enter service in 1989. The engine will be built under licence in Italy and in Brazil.

Rolls-Royce has supplied 11 engines for the prototype and pre-production AMX aircraft. The initial production programme calls for 187 aircraft for the Italian Air Force and 79 for the Brazilian Air Force.

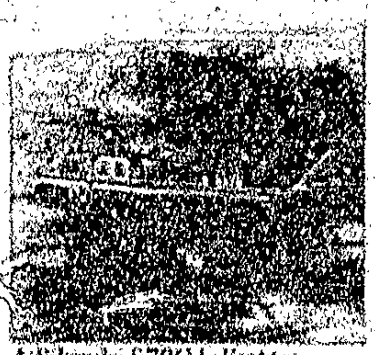
Prototype flying commenced in both countries throughout Piso, and the second Embraer built prototype made its maiden flight in December. Plans were announced by Aermacchi and Embraer during the year, for a two-seat version that could also be used for tactical missions.

The Mk 807, a more rehated engine with a thrust of 11,030 lb was selected for its proven reliability, low operating costs and good power output.

Italian/Brazilian AMX powered by the Spey Mk807 engine



An air defence Tornado takes off with vehicle heat from its two RB199 engines



A Sikorsky S70C helicopter demonstrating the new RTM322 engine

Viper

The Viper turbojet, which first entered service in the 1950s, has been continuously developed to retain its competitiveness. More than 5,500 Vipers have been sold and the engine has now powered 23 types of aircraft; it has accumulated over eight million hours of operating experience. Manufacture of Vipers continued under licence during 1986 in Italy, Romania and Yugoslavia. The engine's current applications include the Aermacchi MB 326K and MB 339, the Yugoslavian Super Galeb, and the Orao strike-aircraft which was developed jointly by Romania and Yugoslavia.

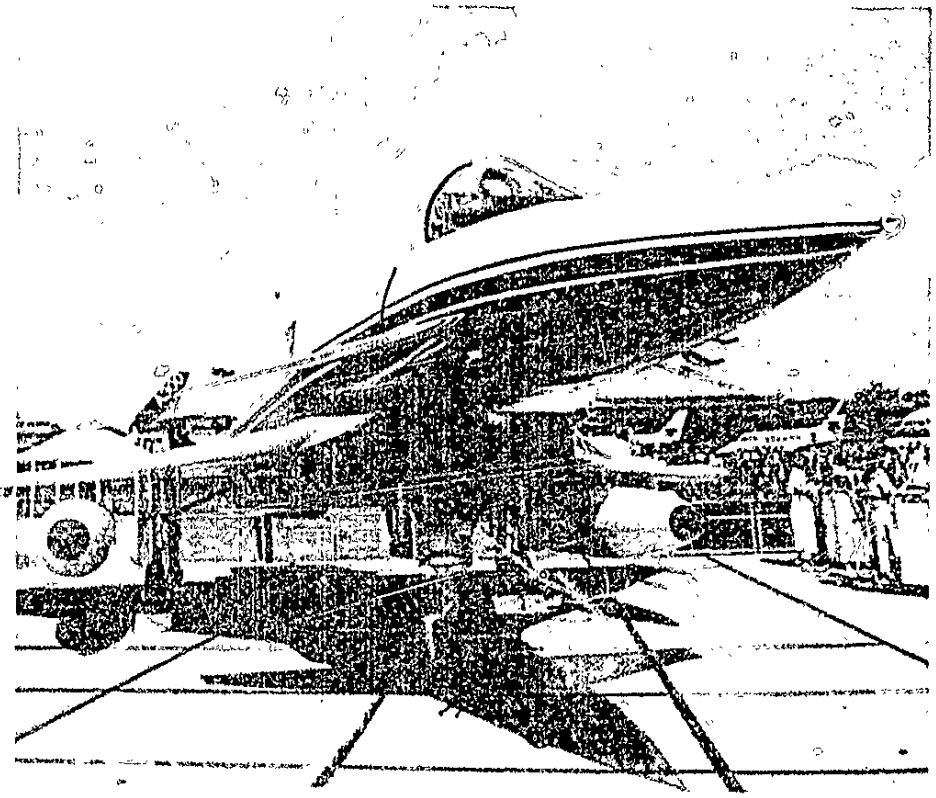
The latest model, the Viper Mk 680, completed intensive flight trials at Bristol in 1986 in an Aermacchi MB 339 trainer. It provides up to 15 per cent more thrust than the most powerful of the earlier Vipers.

Helicopter engines

The advanced RTM322 helicopter engine is being developed jointly by Rolls-Royce and Turbomeca. Flight testing began in June in a Sikorsky S70C helicopter operated by Rolls-Royce and subsequently demonstrated at the Farnborough Air Show.

There is increasing interest in the RTM322 as a powerplant for medium-sized helicopters. In November United Technologies took up their option to licence the RTM322, enabling Pratt & Whitney to build and market the engine for North American government sales. During 1986 Piaggio signed an agreement to take a work and revenue share in the RTM322 programme. The engine will be included in the marketing arrangements under the European small engine collaboration agreement signed by Rolls-Royce, Turbomeca and MTU in April 1985.

The Gnome turboshaft continued in production during 1986 for Westland Sea King helicopters, with an order received from India. Further orders were received for Gnome engines pro-



Full-scale mock-up of the European Fighter Aircraft (EFA), proposed for the 1990s

value £7.6m to upgrade Swedish Navy Boeing Kawasaki KV 107 helicopters.

The Gem engine entered service in 1976 powering Westland Lynx helicopters and has subsequently been developed for the Agusta A129 Mangusta anti-tank helicopter which is scheduled to enter service with the Italian army in 1987. In September, a Gem powered Lynx raised the world speed record for helicopters to 249mph. An order was received for 63 Gem engines to power the twin-engined Westland 30 helicopters bought by the Helicopter Corporation of India for work in offshore oil fields.

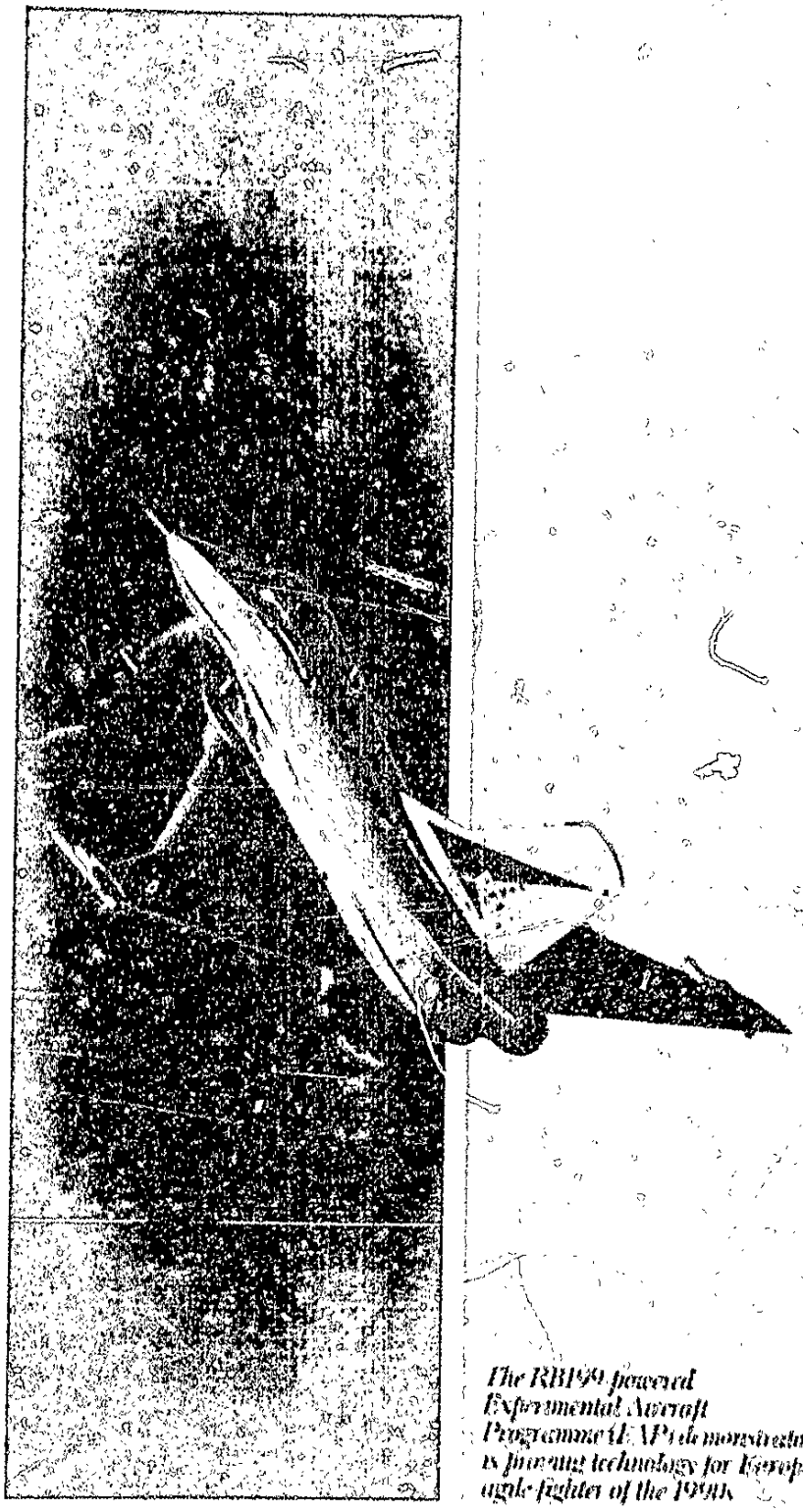
EFA engine

In December a new joint company Eurojet Turbo GmbH was formed by Rolls Royce MTU, Fiat Avio, Bone and SNECMA of Spain to control and co-ordinate the joint design, development and manufacture of an engine for the proposed new European Fighter Aircraft (EFA), currently in the definition phase.

This engine, the EJ200, will be designed as a reheated two spool turbofan in the 20,000lb thrust class and will incorporate Europe's latest engine technology in order to optimise its performance, reliability, maintenance and operational costs. The Rolls Royce XG40 advanced military demonstrator provides the technical basis for the Rolls Royce contribution to the EFA engine project.

If EFA goes ahead as currently proposed, the EJ200 would enter service in the mid-1990s. The programme is expected to cover about 800 aircraft for the air forces of the four nations taking part, as well as providing export opportunities.

The structure of the new joint company reflects the experience gained by Turbo Union on the RB199 programme. Work shares are related to each company's stake in the aircraft programme, with Rolls Royce and MTU having 33 per cent each, Fiat Avio 21 per cent and SNECMA 13 per cent.



The RB199 powered Experimental Aircraft Programme (EAP) demonstrator is proving technology for Europe's agile fighter of the 1990s.

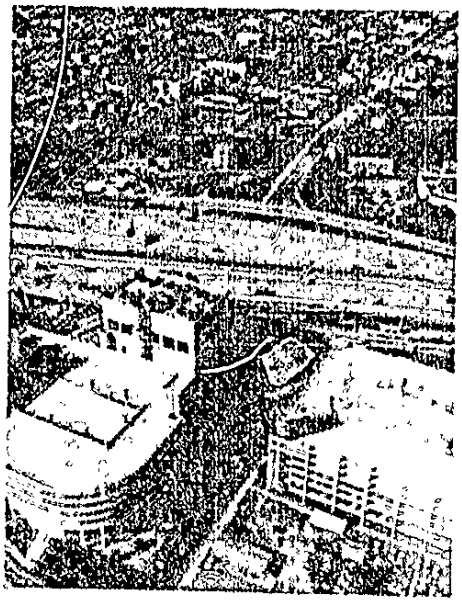
An Olympus generating set – fuelled by gas produced from coal and installed at Westfield, Scotland – successfully completed its first run during 1986

The business group produces gas turbines for power generation and for gas and oil pumping, and has more than 150 industrial customers. It also provides gas turbine power for some 45% of the world's naval forces.

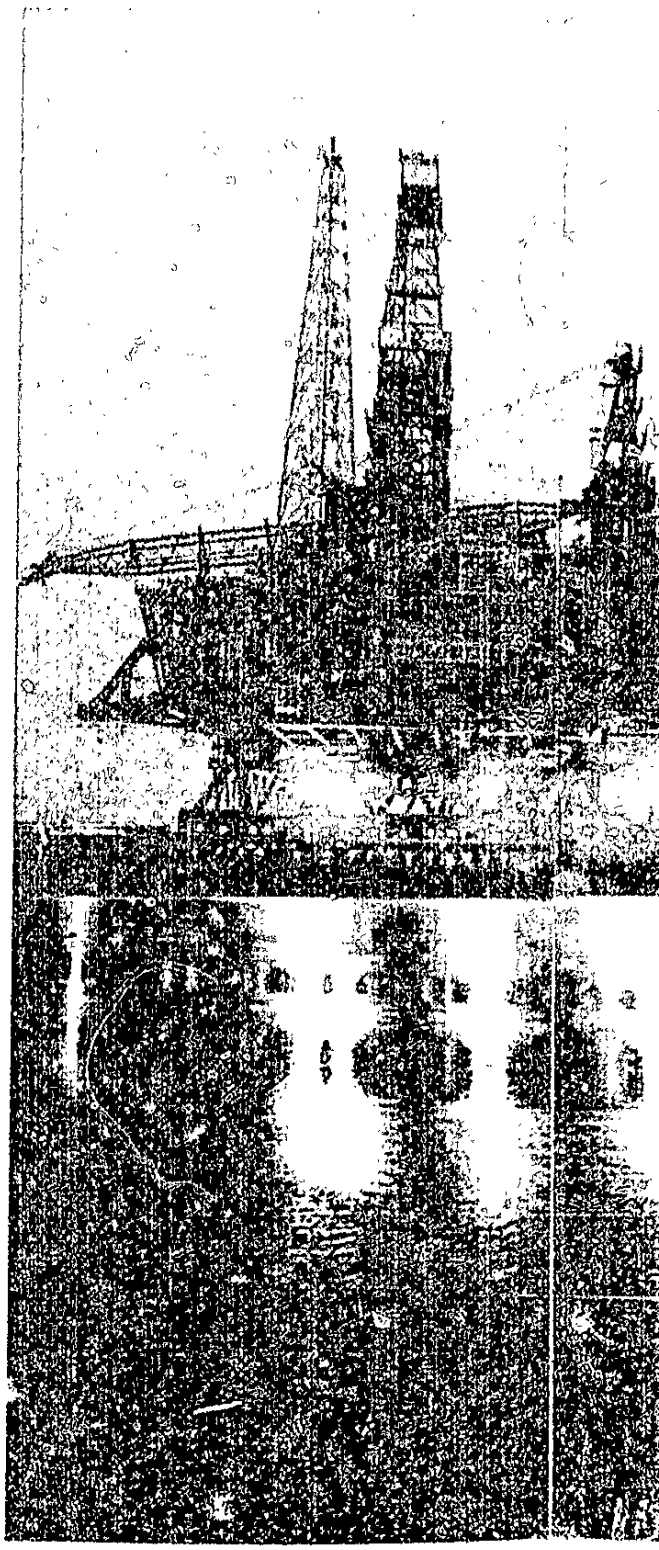
The industrial business was affected by reduced oil prices during 1986, causing the continued contraction of the worldwide market for industrial gas turbines. One of the largest orders placed for seven Avon powered units was won by Cooper Rolls, a joint venture company with Cooper Industries of the USA.

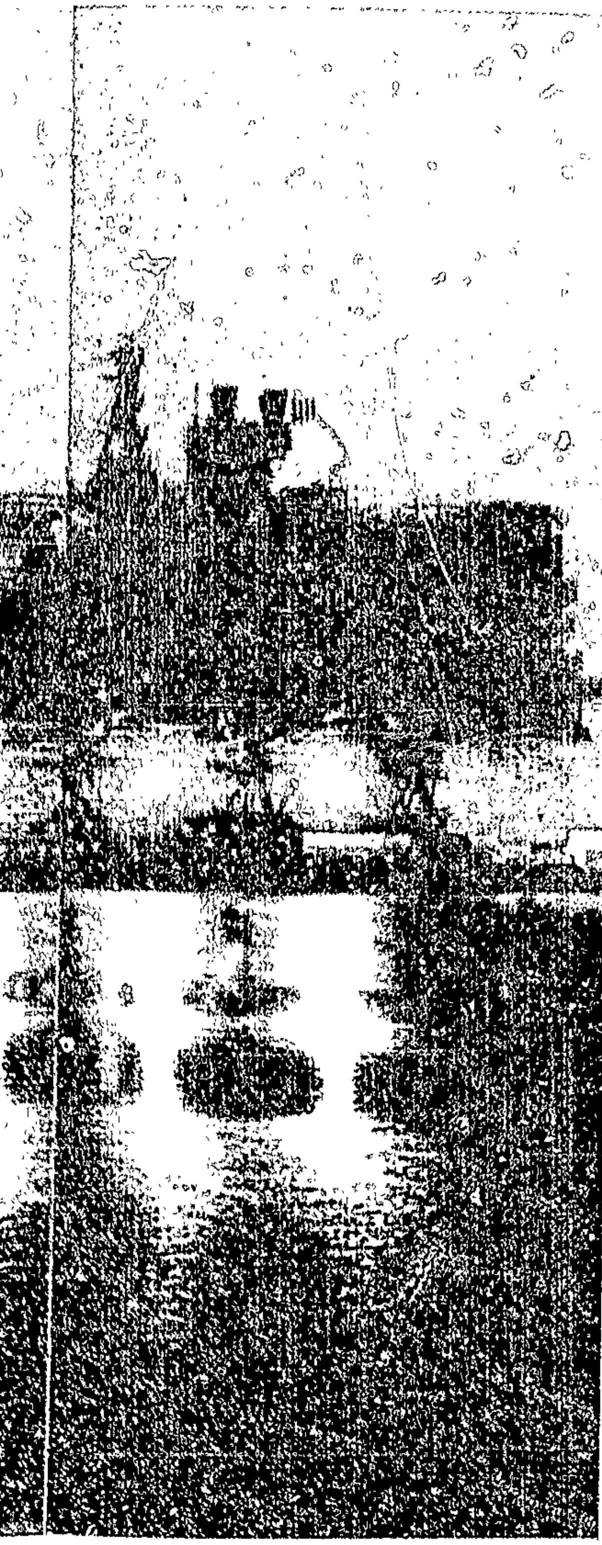
Deliveries of Spey powered SK15H generating sets to China began with two units for the Da Qing oilfield. Negotiations continue for additional Spey sets and on the agreement for joint manufacture of SK15H gas generators in the United Kingdom and China.

Two major power station projects were completed during 1986. One was in Holland, where a second Olympus installation providing both heat and power has been installed, it operates at an estimated 80 per cent thermal efficiency. The second is the $28.5 million cogeneration plant in the Dade County Downtown Government Center, Miami, which entered full scale



A co-generation plant using an industrial Olympus provides electrical and thermal power for a large complex of government buildings in Dade County, Miami





operation at the end of 1986. This plant was designed and constructed by the Thermo Electron Corporation.

A highlight of the year was the first run in Scotland of an Olympus unit which operates on gas produced from coal. A full power 20 MW test was completed at the end of 1986 and a programme of endurance runs will be undertaken early in 1987.

Marine orders during the year were again dominated by the Spey. The Royal Netherlands Navy ordered eight SM1C units to power a second batch of four M-class frigates and Japan ordered additional engines for its naval programme.

By the end of 1986 Speys had been ordered for 26 warships and the first operational units for HMS Brave and the Japanese frigate Hatakaze had been accepted into service with the Royal Navy and the Japanese Maritime Self Defence Force. Another new design of warship, the British Type 23 frigate, was ordered during 1986 and will be powered by the Spey.

Development of the marine Spey continued, with build of the first uprated 19.5 MW version starting in late 1986. This will initially power ships of the Royal Navy and the Royal Netherlands Navy.

In response to a US Navy requirement, a preliminary design of an intercooled regenerative version of the Spey engine was submitted by Rolls-Royce in collaboration with two US partners, the Allison Gas Turbine Division of General Motors Corporation and the Garrett Turbine Engine Company. Power units giving a 30 per cent improvement in fuel consumption over existing engines for a typical mission are required. If the proposal is successful it could form the basis for future naval propulsion.

During 1986 the Royal Navy undertook a promotional tour of the world, deploying a fleet of warships on Global 86. Four of the major vessels were Rolls-Royce powered and the visits were helpful in promoting Rolls-Royce products particularly in the Far East.

Marine Speys entered service in 1986 powering the frigate HMS Brave

A Conoco North Sea oil platform equipped with Avon-powered generating sets

Mock-up of a high bypass engine project for future large airliners

This group is responsible for the application of the Company's engineering resources for research, technology design and advanced engineering programmes.

During 1980 achievements by Corporate Engineering ranged from future project design through advanced engineering to the support of business group engine programmes.

Future projects

In the civil field, renewed emphasis has been put on the further potential of the RB211-524 beyond the D10 version. Prospects exist for technically attractive developments based on past and present demonstrator programmes, ready to be launched when a suitable business opportunity is defined. These programmes aim at thrust increases and reductions in fuel consumption.

A turboprop version of the RM322 turboshaft engine has entered the final stage of definition before a launch decision. It is an advanced engine in the 2,000shp class for 30-40 seat commuter aircraft based on the core of the RM322 helicopter engine which has been jointly developed by Rolls-Royce and the French company Turbomeca.

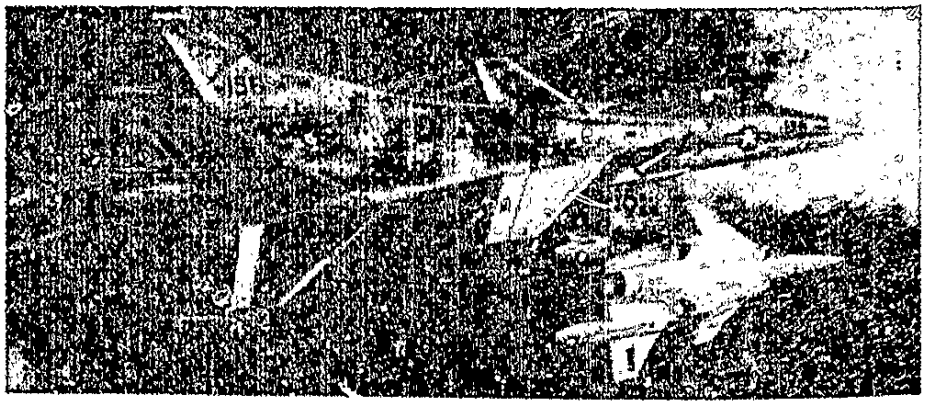
Also under study is the larger RB30 turboprop in the 3,200shp class, it is based on scaling up of the RM322 core and would power possible new 60-80 seat civil aircraft.

During the second half of 1980 Rolls-Royce and the other IAE partner companies completed an initial feasibility study of the SuperFan, a very high bypass derivative of the 25,000lb thrust V2500 with a geared fan. This concept is of interest to Boeing for their projected 7J7 aircraft and has been selected by Airbus Industrie for possible application on the proposed A310 airliner. A decision to accelerate the engineering work on SuperFan was made in December.

Other projects are aimed at very long-term developments in the civil market. At the large engine sizes up to 60,000lb take-off thrust and above – advances in both core and nacelle design of high bypass configurations have indicated that large savings in fuel consumption should be possible relative to today's engines, with no weight penalty.

In a lower-thrust sector of the market, the propfan has also received attention – resulting in a family of project designs with powers ranging from 9,000 to 15,000hp, suitable for 100 to 180-seat aircraft. The core of the military XG40 demonstrator engine has been chosen as the basis of this family because of its low-cost design.

Work on future military engines is preparing the ground for supersonic V/STOL aircraft. This was brought one stage nearer by the memorandum of understanding between the UK and US governments for advanced V/STOL technical studies and by an arrangement between Rolls-Royce and Pratt & Whitney relating to possible further joint work on propulsion systems for advanced V/STOL aircraft.



Artist's impression of supersonic V/STOL aircraft concepts powered by vectored-thrust engines