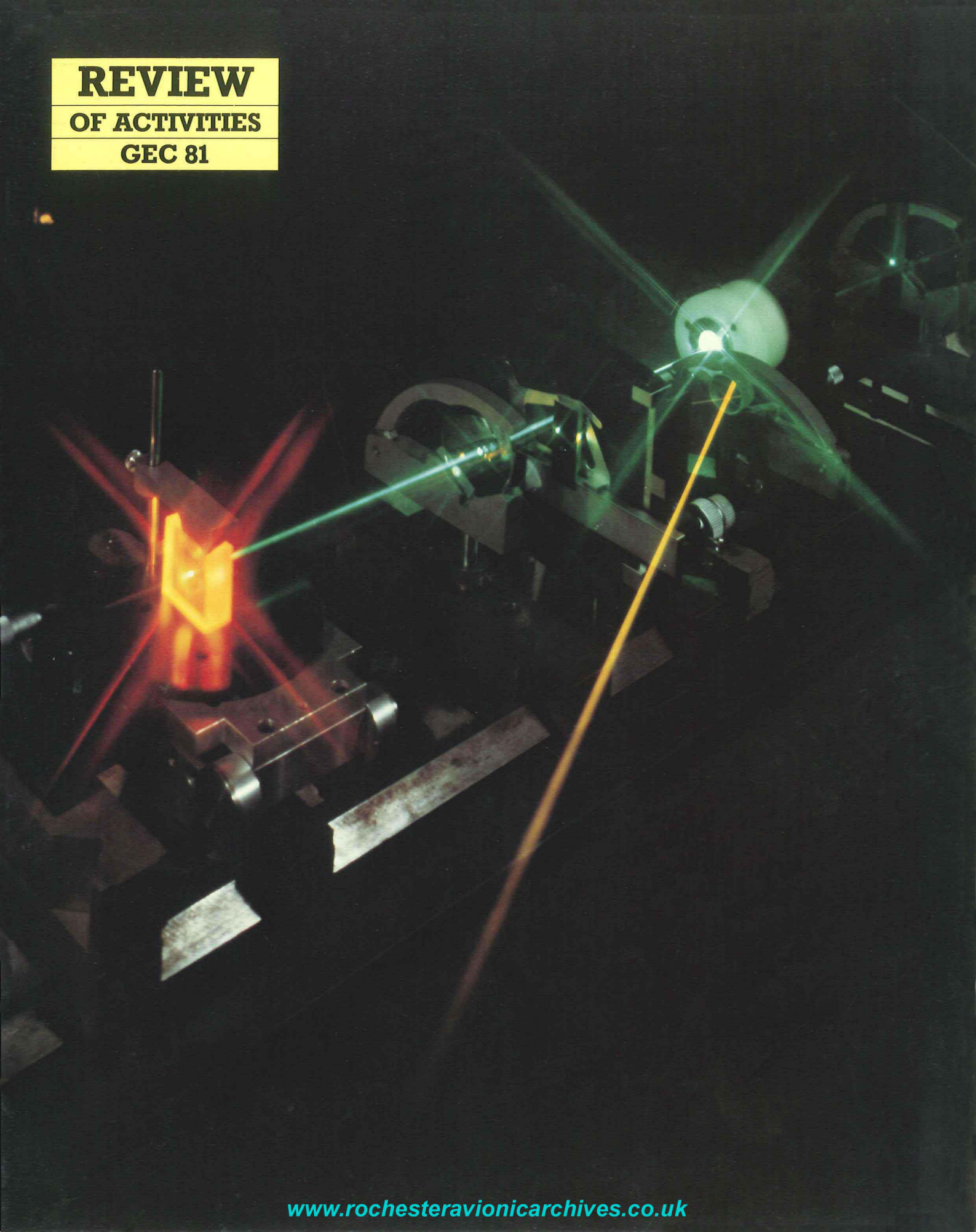


REVIEW
OF ACTIVITIES
GEC 81



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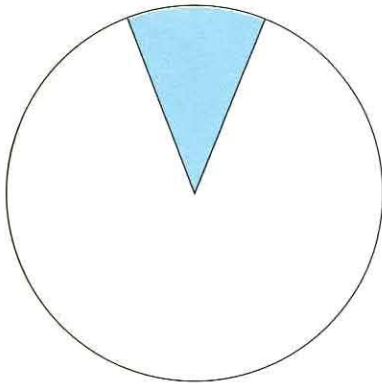
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COVER STORY

A tuneable beam of light being emitted from a dye laser at GEC's Hirst Research Centre. The dye laser is itself pumped by a more powerful frequency-doubled, Q-switched, pulsed neodymium YAG laser.

Lasers have many applications ranging from industrial and defence systems to semi-conductor processing technology and metallurgy; in medicine for delicate surgery and in metrology (the science of measurement).

POWER ENGINEERING



23,000 Employees

	1981	1980
TURNOVER	£531m	£427m
EXPORT SALES	£341m	£216m
EXPORT ORDERS	£434m	£323m
PROFITS	£61m	£46m

The increase in turnover in 1981 was entirely derived from higher exports. Profits generally increased but were most marked in Turbine Generators and Switchgear.

GEC Turbine Generators Ltd made good progress in the execution of major contracts in South Africa, Korea and Hong Kong.

Orders were obtained from the South of Scotland Electricity Board for two 660MW units for Torness and from Calgary Power Limited in Canada for two 440MW units for the Keephills Station in Alberta. Together with the six 600MW units from ESCOM in South Africa for its Tutuka power station, the total orders obtained by GEC Turbine Generators for the year amounted to 5800MW, with a contract value of £450 million.

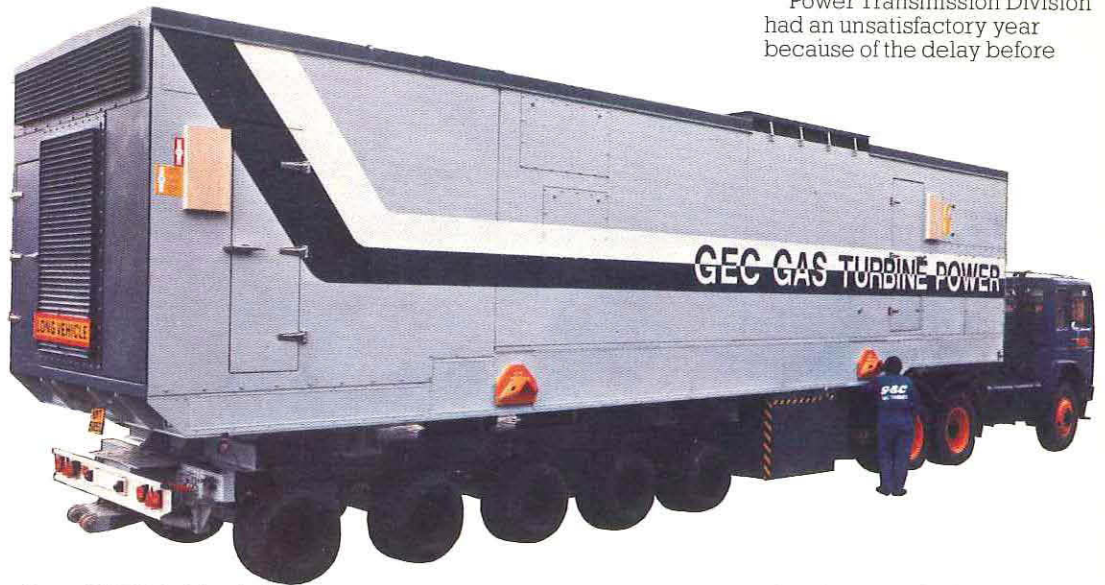
Deliveries during the year included four of the 60MW industrial gas turbines for Hong Kong and several of the new packaged 15MW modules for offshore platforms for Abu Dhabi.

Ruston Gas Turbines Ltd again shipped a record number of units. Higher sales volume and continuing improvements in production methods enabled profitability to be maintained despite increased competitive pressure on prices. The entire output went abroad or for North

complete metalclad SF6 installation. Deliveries to site of Britain's first 145kV metalclad SF6 substation were completed, as were the circuit breakers for Castle Peak 'A' power station in Hong Kong.

The Advanced Development Laboratory now being commissioned at Stafford, and service experience gained from the commissioning of various prototype contract equipments, contributed to good progress in development projects.

Power Transmission Division had an unsatisfactory year because of the delay before



One of GEC Turbine Ltd's new mobile power stations. Each station has an output of 21,600 kW and four of this type have been ordered for the Middle East.

After the end of the year, a Letter of Intent was received from China Light & Power Company Limited and Eastern Energy Limited for Castle Peak 'B' power station in Hong Kong, valued at £550 million, the biggest single export order likely to be placed for manufacture in the UK. A Letter of Intent has also been obtained for a combined cycle project in Argentina.

The Queen's Award for Export Achievement was won for the third time.

GEC Gas Turbines Ltd's export orders included nine large mobile generating sets for the Middle East. Four of these were of the new 22MW size capable of handling three alternative fuels. Outside the areas where sales are well established, an order was received from Japan for an Indian offshore oil application.

Sea. With the addition of South Yemen, Brunei and Japan and an order for eleven gas turbines for the Danish North Sea, Ruston's export territories were increased to forty-four.

The introduction of the 8500 horsepower 'Tornado' in 1982, with improved thermal efficiency, will enable Ruston to compete even more effectively for larger horsepower business in the face of increasing energy costs.

Napier Turbochargers Ltd, in a generally static market, continued to widen its distribution and achieved higher export sales. New turbocharger models are being developed to match the drive for fuel economy in diesel engines.

GEC High Voltage Switchgear Ltd improved on the previous year's performance through better cost control and higher productivity. Orders were difficult to obtain in export markets, but at home it was successful in gaining the important CEBG City Road 400kV substation order for a

planning permission was granted for the cross channel dc link; this has now been obtained. Five major ac compensation schemes were commissioned during the year, maintaining the Division's important international position in this specialised field.

GEC Distribution Switchgear Ltd's results improved on the previous year, which was disrupted by labour troubles. Half the output was exported, and at home the commissioning was completed of the whole of the 11kV and 3.3kV switchgear for the Sullom Voe oil terminal.

In vacuum switchgear, the new 36kV units have been well received in the market. Although the order book is below last year's level, the introduction of further new products will enhance prospects.

GEC Power Transformers Ltd is now benefiting from its reorganisation and continued investment in new equipment. Reductions in costs have enabled a number of important contracts from both home and overseas to

THE CHAIRMAN'S STATEMENT

The Review of Activities covers in detail the respective fortunes of the Company's separate businesses. The Review brings out clearly that it has been a tough world in which GEC has operated in the last twelve months and we do not expect it to become easier. We do not complain about this; no Government can make too much difference in the short-term to the adverse economic factors with which Britain is confronted and it is our job to do our best in the prevailing circumstances.

It would be surprising if there is anyone in GEC, or many in private industry, to whom we still need to repeat the rhetoric that the world does not owe us a living, or how far we still have to go to match our best overseas competitors. However, there are apparently still many people in the country who seem to be immune to the pressures of these economic facts, most especially those whose wages depend upon the power of Government to compel the rest of us to pay the bill. As I write this, a large part of the administrative civil service is striking for a pay increase of more than seven per cent to add to the fifty per cent they have already received in the last two years.

July 1981

Nationalised industries have, in a number of cases, agreed pay settlements well over anything companies earning their living in the world markets can offer, and have met the cost by imposing increased prices for their services which have run far ahead of average price increases. In local Government, many promises have been made to increase expenditure on various services, presumably to be paid for by even further increases in rates.

Perhaps Government should agonise less about macro-economic theory and concentrate more on the improvement of the management of the enormous sector of the national economy which it directly or indirectly controls. This is perhaps less interesting and undoubtedly less exciting, but is certainly most necessary in the interests of all whose wellbeing depends on our ability to trade competitively in the world – and that includes virtually the whole of the British nation.

This sort of unromantic approach has over the years made your Company relatively stronger than quite a lot of other organisations. We intend to continue in the same way in the future.

John of Stafford

be secured. Sales were considerably higher than for the previous year, and included a number of large generator transformers – the biggest, an 800MVA 3 phase unit for Korea – and the first shipment of transformers for the Castle Peak 'A' power station in Hong Kong.

production methods introduced over the last two years. Total shipments of cast-in resin distribution transformers now exceed 100MVA, and with a wider range of factory assembled package substations coming through to manufacture, there are more opportunities to obtain export business.

GEC Rectifiers Ltd increased both sales and profit over the previous year. Railway trackside equipment was successfully commissioned in Washington DC. The initial system for Hong Kong Mass Transit was completed, and work is well advanced on an accelerated programme for the Tuen Wan extension. Order intake in the year was down, mainly due to the lack of any major large project, but quite substantial orders were won for power supply equipment.

Development of advanced forms of transistorised power conditioning units continues; after successful commissioning of the first prototype in Canada, an order was obtained for pre-production units to be delivered later this year. Equipment is to be supplied for the MAGLEV People Mover project for Birmingham airport, including the dc substation and the vehicle borne transistorised levitation and propulsion power conditioning units.

GEC Energy Systems Ltd, formerly GEC Reactor Equipment Ltd, continued work on the completion of the AGR stations at Hartlepool and

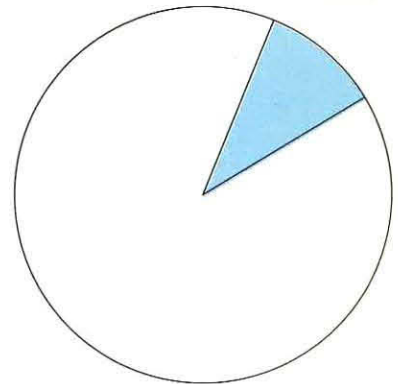
Heysham. A second dry storage facility for irradiated fuel has been constructed at the Wylfa station, and experience in fuel storage has led to other orders including work in the USA. Contracts were also won for equipment for the 'JET' fusion project being constructed in the UK at Culham, and for the main installation work.

This business is now responsible for alternative and renewable energy systems, including hydro-electric, wind power and energy storage projects.

The Micanite & Insulators Company Ltd's profits were down in the year due to severely reduced demand for HV insulation in the UK. Opportunities have been taken to vacate older premises and to modernise processing plants. Good progress has been made in the development of new products to eliminate environmental pollution and to improve electrical performance. Sales of non-toxic, biogradable 'Midel' fluids have increased, and a licence to allow manufacture in the USA has been completed.

GEC Reinforced Plastics Ltd had a successful year with increased sales and profits, and was able to maintain its order book. Capital expenditure is being undertaken in order to widen the product range of thermo-set mouldings, and prospects are further improved with the possibility of substantial orders for the cross channel dc link.

INDUSTRIAL



20,000 Employees

	1981	1980
TURNOVER	£366m	£334m
EXPORT SALES	£144m	£123m
EXPORT ORDERS	£171m	£133m
PROFITS	£42m	£48m

There was generally a turndown in the profits of the individual businesses although this trend was not followed by diesels and the lift company which reported slightly improved results. The engineering company at Accrington did much better, but the Simplex agricultural equipment activity had a very bad year.

GEC Diesels Ltd, including its overseas subsidiaries which are reported on separately, had a better year with higher sales and profits. Prospects are still adversely affected by the world recession in the construction, fishing and shipbuilding industries, but competitiveness



The completed core and winding assembly of an 250 MVA auto-transformer being lifted for fitting into its tank at GEC Power Transformers Ltd Stafford.

GEC Distribution Transformers Ltd, in a depressed market, performed better due to new products and innovations in

is being increased by efforts to reduce costs and to improve manufacturing efficiency.

Dorman Diesels Ltd had a difficult year with many of the workforce on short time for long periods. Cost effective measures and higher export sales in the second half of the year combined to produce slightly higher profits than in the previous year. Work on improving manufacturing techniques and on product development is continuing, and, with some signs of uplift in the market, further progress in the current year is expected.

engines, similar to those used on the successful British Rail High Speed Train, and Deltic engines to the Indian Navy for installation in coastguard vessels. Further orders are expected from the Australian Railways for 12-cylinder Valentas. The first order was received from the Oman Navy for the 18-cylinder version of the RP200 Valenta engine, and there are good prospects for further naval marine export business. The home market is currently restrained by H M Government policy of spending restraints. Substantial new capital

profits fell due to production and commissioning delays. At home, equipment was successfully introduced in the Glasgow Underground and the Tyne and Wear Metro. Abroad, new type dc propulsion equipment was delivered for suburban stock in Australia, Brazil, Hong Kong, New Zealand and Portugal. Deliveries of repeat equipment continued for South African Railways, Hong Kong Mass Transit, British Rail and London Transport. Orders received were also up on last year with a similar export content. They included the main drives for electrification of the Dublin suburban services and orders from Hong Kong and South Africa. The growth of traction markets worldwide provides good opportunities for this business.

GEC Engineering (Accrington) Ltd showed improvement in sales and profits due to a greater demand for aircraft and aluminium fabrication work. Forward orders are at a reasonable level but prospects look less promising than a year ago.

GEC Large Machines Ltd experienced deteriorating trading conditions as the year progressed, and there is little sign of improvement. But two substantial contracts were secured for hydro-generators: two 40 MVA machines for India and three 95MVA units for Sri Lanka. Site erection work continued on the 330 MVA generator/motors for the CEBG Dinorwic pumped storage station, and also on the machines for the JET project for the European Atomic Energy Community.

GEC Small Machines Ltd had a difficult year, with the fractional horsepower motor business being the worst hit. Export sales held up reasonably well but demand in the UK was affected by the general economic situation and de-stocking by customers. Measures have been taken to bring capacity in line with expected future demand, and this has necessitated the closure of a factory near Doncaster, leaving the work to be concentrated at other locations.

The Witton-Kramer Ltd business was also affected by the fall off in demand, although it managed to increase its exports to 40 per cent of output.

GEC Marine & Industrial Gears Ltd maintained turnover but profits were reduced. Order intake was affected adversely by the temporary deferment of some business at home and abroad.

GEC Foundries Ltd's business tapered off in the second half of the year. It maintained its market share and, following the installation of a new automatic moulding plant at Dick Lane, is now attracting new business. The Moulded Plastics Division also did less well than in the previous year, although demand is now increasing.

Despite efforts to maintain production at the Avery's Tame Bridge Foundry there were no foreseeable prospects of filling the capacity at an economic level and the plant was closed in April 1981.

The Express Lift Company Ltd had higher sales and a slightly improved profit. Export sales amounted to 30 per cent of lift turnover, but new export orders declined. Home business benefited from programmes by local authorities to reconstruct ageing lifts, and from the introduction of a more sophisticated product range.

Claudgen Ltd's profits were down, affected partly by reduced heating sales as a result of a mild winter. A new portable fan heater branded GEC has been introduced in the consumer market. With a growing order book on advertising signs and lighting, which includes a contract to re-sign Midland Bank branches, a new manufacturing unit has been opened in Manchester. Major sign installations included the largest Coca-Cola sign in the world mounted on the Rotunda in Birmingham's City Centre.

Woods of Colchester Ltd's results were adversely affected by the decline in orders from the construction industry, although exports held up well. Emphasis has been given to the development of new products and to improvements in productivity.

Keith Blackman Ltd increased sales in the home market of its Series 28 fans. Its new factory at Rugby became fully operational, and the Arbroath factory, at which major contracts associated with the Ministry of Defence (Naval) have been concentrated, operated to full capacity.



A tug operating in Hong Kong harbour and powered by a diesel engine made by Kelvin Diesels Ltd Glasgow. The engine develops 440 bhp at 1200 rev/min.

investment in manufacturing facilities has been maintained and will continue.

Ruston Diesels Ltd benefited from deliveries of engines arising from orders taken previously in the marine market, but, overall, trading conditions and orders in hand declined sharply. Orders were received from the USA for the first of the new range of RK270 spark-ignition engines to run on natural gas, and for the first of the new design of larger medium speed AT350 engines. Both these engine ranges are expected to make a growing contribution to sales volume in the future. There are other favourable prospects in export markets for industrial power generation equipment, and for engines for North Sea Oil applications.

GEC Traction Ltd increased sales during the year, with around two-thirds for export, although

Kelvin Diesels Ltd reported higher sales and profits. The worldwide recession has delayed major projects in the fishing industry for new boatbuilding and re-engining programmes, but a very large contract was secured for engines and associated marine equipment from the Inland Water Transport Corporation of Burma. Traditional export areas, such as the Arabian Gulf, West and East Africa, show signs of improvement, but the home market remains depressed because of the indecision on fishing limits by the EEC.

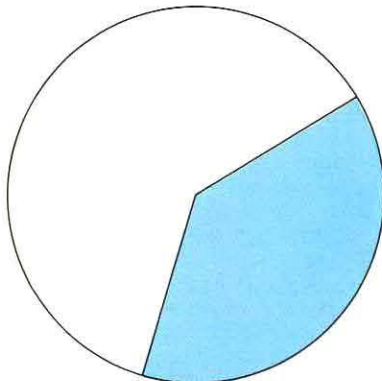
Paxman Diesels Ltd improved turnover and profits. Sales included deliveries to the Australian Railways of RP200

Greenwood Airvac Ventilation Ltd results were not unsatisfactory in light of conditions in the building construction industry to which it supplies unit ventilating equipment. The introduction of new products and higher overseas sales made positive contributions.

Simplex of Cambridge Ltd had a very bad year as a result of the severe recession in the agricultural industry. Sales were less than one-half of the previous year, and a heavy loss was incurred.

Parnall & Sons Ltd suffered from the depressed market for office furniture; sales and profits were down. There is no immediate prospect of improvement in trading conditions.

**ELECTRONICS,
AUTOMATION &
TELECOMMUNICATIONS**



74,000 Employees

	1981	1980
TURNOVER	£1235m	£1042m
EXPORT SALES	£327m	£330m
EXPORT ORDERS	£483m	£337m
PROFITS	£160m	£135m

The strong general trend of improving results of recent years was maintained, although some individual businesses were not able to better their profits of the previous year.

Telecommunications, avionics, space and defence systems, and computers all achieved considerable advances in turnover.

Marconi Avionics Ltd recorded another year of sound growth. Its turnover was up by a third, helped by higher exports, particularly to the USA. Progress is being made in the drive to

develop high technology products outside the traditional avionics market. Important examples have been the new 'fail safe' electronics for controlling subsea oil wells, and standardised thermal imaging equipment for defence.

Production for US customers included head-up displays for General Dynamics F-16 fighters and Vought Corsair aircraft, helicopter air data and laser range-finding equipment for US Army programmes, and doppler navigation and automatic throttle control systems for Boeing airliners. The US Air Force has placed a \$100 million contract for the development of a new, advanced type of aircraft head-up display. Principal sales to Europe were for the Tornado aircraft. At home, satisfactory progress was made with the Tornado airborne interception radar, and the complete mission system avionics for the AEW Nimrod aircraft. New anti-submarine electronic equipment was accepted for Royal Navy helicopters.

Marconi Communication Systems Ltd had a difficult year, with sales, orders and profit down on the previous year. Competition from Japan and Germany was particularly severe for broadcast transmitter and television studio equipment. In satellite communications, a major order was received from British Telecom for the first shore station, following the establishment of the Inmarsat organisation to cover civil maritime requirements. Major orders were also recorded for an Intelsat C earth station for British Telecom and an Intelsat B earth station for Nepal. Business was gained for microwave and tropospheric scatter equipment for North Sea oil communication links. In defence communications, the naval HF equipment has now been purchased by the US, Dutch and Greek Navies, in addition to the Royal Navy. Orders for PCM systems and data modems for British Telecom have continued at a high level.

Marconi Radar Systems Ltd. Sales and profit were lower, but the order intake was favourably ahead, including a share of the £100 million UKADGE contract for command and control systems awarded to a consortium of Marconi Radar, Hughes and Plessey; this should lead to substantial follow-on business. Other orders included a

complete radar convoy for the Gulf, and equipment to modernise gun control and fire control systems for tanks in the Far East.

Major shipments to the Middle East continued during the year of weapon systems for fast strike craft.

defence moratorium, and overseas the strength of sterling made it more difficult to secure business at remunerative prices. On the other hand, orders and sales of automatic test equipment showed encouraging growth, particularly in export markets. Investment in new product



New from Marconi Instruments Ltd is this fully-programmable, microprocessor-controlled precision signal generator covering 10 kHz to 1024 MHz. It is used principally for testing radio receivers.

development was maintained at a high level. Initial market reaction to a new range of signal generators has been favourable.

Marconi International Marine Company Ltd's trading remained affected by the world depression in the shipbuilding and shipping industries, but a modest increase was achieved in turnover and profit, and the proportion of exports was maintained at over two-thirds of total sales.

Easams Ltd enjoyed further substantial growth in profit, new orders and sales, eighty per cent for export. Major resources continued to be devoted to the Tornado aircraft contracts, and although prospects remain good, the shortage of suitable qualified engineers curbs expansion.

McMichael Ltd achieved a fifty per cent increase in sales and profit. Military communications and data processing equipment constituted the major proportion of sales, but dependence on defence has been reduced through the development of new civil communications products, which made an important contribution to a record order book.

Marconi Space and Defence Systems Ltd had a very successful year, with sales and profit well up and a record order book. A new factory at Neston was recently opened for the assembly and test of the Sting Ray torpedo, of which production has now started.

Although export sales were down, recent new orders for DN 181 for Switzerland and the US Air Force, and for tank fire control systems will reverse this trend. A new range of military communication products is being introduced including radio relay systems, frequency hopping tactical radios and associated crypto equipments.

Marconi Instruments Ltd maintained its turnover but profit was much lower despite substantial economies in direct and indirect costs. Orders in the UK for instruments declined due to economic conditions and to the

GEC-General Signal Ltd's performance was better than in the previous year. Work continued on major resignalling contracts for British Rail at London Victoria, and at Edinburgh and East of Scotland, and a new contract has commenced at Anglia West. The train describer for London Victoria has been installed on site, as have sections for London Liverpool Street. Substantial deliveries were made for the Brazil/ Rio Sao Paulo resignalling contract.

improved. Export successes included the first sales of GEC 4000 computer systems in Austria, Belgium and Italy. The order book rose again during the year, but its growth is likely to slow down for the time being. Prospects beyond the current year will be heightened by the introduction of more new products.

GEC Medical Equipment Ltd's results showed some improvement and, benefiting from the introduction of new

offset a downturn in business for some of the more conventional motor control products.

GEC Electrical Projects Ltd increased its order intake, with an even higher content of export business. A new Automation Systems Division has been established to consolidate its position as a major supplier to the process industries of microprocessor-based control systems using GEM 80 equipment. Steps have been taken to move into the field of factory automation systems which will include robots, programmable controllers, numerical controllers, and computers, all available from within GEC. Such systems are intended to eliminate repetitive and often hazardous tasks now performed by humans.

GEC Mechanical Handling Ltd achieved a similar turnover to that of last year but profits were lower because of an unsatisfactory out-turn on a major contract. Order intake was down and steps have been taken to reduce capacity and to increase margins.

GEC Transportation Projects Ltd. Design work is proceeding well on the Brazil contract, and instructions for the commencement of manufacture is expected in 1981. A management contract was secured for a railway electrification scheme in Zimbabwe, and the unit has been selected as project manager and system engineer for the MAGLEV People Mover system to be built at Birmingham airport.

Hall Automation Ltd, which manufactures robots for spray painting, arc welding and general transfer applications, did not fulfil its plans. However, some progress was made; development of a new compact spray painting robot designated 'CompArm' has reached completion, and orders have been received from British Leyland and Ford. The prospects for sales of 'CompArm' and all types of robots look promising. The Company received the Queen's Award for Technological Achievement in 1981.

GEC Telecommunications Ltd's results reflected substantially higher sales, and the volume of orders received resulted in a record order book at the year end.

In transmission systems, the growth in sales and order input included an increasing proportion of digital equipment. This reflects the importance of this new technology in the future for the UK network and overseas. The first 140 Mbit/s section of British Telecom's new optical fibre digital network was successfully installed and commissioned on a route between London and Reading. Substantial orders for digital multiplex and cable systems include the two longest digital systems in the UK. They connect, via alternative routes, the international switching centre in London to the new satellite ground station at Madley, Hertfordshire. Orders for microwave-radio equipment for a further expansion of the UK network include circuits for the second ITV channel. In Bolivia, a £6.7 million expansion of the national microwave-radio network was completed on time despite unprecedented bad weather conditions in the High Andes.

Sales of telephone instruments did not increase to the extent planned due to deferrals in deliveries to British Telecom. But exports improved and several new products were introduced.

Sales of public exchange systems rose to a new record level with substantial increases in Crossbar and TXE4. The introduction of sophisticated production facilities for the new range of digital computer-controlled private telephone exchanges has resulted in a dramatic increase in sales and order input. A repeat order worth £18 million was received from British Telecom for the CDSS-1 system (Monarch).

Reliance Systems Ltd had a satisfactory year. It was particularly successful in securing orders for SL-1 exchanges; there is considerable customer satisfaction with its modern facilities combined with trouble-free operation. A new internal telephone system, Fastphone, was launched towards the end of the year and has been well received.

Associated Automation Ltd increased its turnover and profit despite a substantial reduction in British Telecom's demand for coin-operated telephones. Sales and orders for relays were somewhat better than in the previous year.



British Rail's new central operating control room at Clapham, which will eventually control 270 track miles of busy commuter routes in the London area including Victoria Station which is used by 200,000 passengers each day. This major resignalling work is being done by GEC-General Signal Ltd for Southern Region of British Rail and is due for completion in 1983.

products, finished the year with a better order book.

Progress is being made with work in the field of magnetic resonance (NMR) which is a diagnostic imaging technique dispensing with the hazards of radiation. The first sales of this new type of system are expected during the current year.

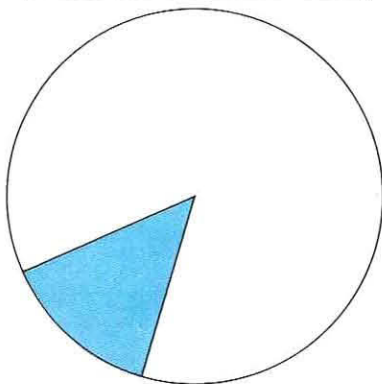
GEC Industrial Controls Ltd increased its sales and profit and, with a higher content of export business, maintained orders up to the level of the previous year. The GEM 80 microprocessor-based industrial control system is rapidly becoming established as one of the most advanced systems of this type in the world. With the acquisition of Herbert Numerical Controls and the introduction of controllers for axis and spindle drives, a total electrical package for the machine tool industry can now be offered. These, and other new advanced electronic developments for ac variable speed drives, are helping to

GEC Traffic Automation Ltd's results were generally satisfactory. Work is in progress on urban traffic control systems for Reading, Plymouth and Sheffield, but there is pressure on local authorities to curb expenditure; new customers overseas are being actively sought.

GEC Computers Ltd increased its sales by sixty per cent, an even faster rate of growth than in the previous year. Despite much higher expenditure on research and development, profitability

COMPONENTS, CABLES

& WIRE



27,000 Employees

	1981	1980
TURNOVER	£464m	£397m
EXPORT SALES	£124m	£108m
EXPORT ORDERS	£96m	£85m
PROFITS	£39m	£35m

The turnover for 1981 included the Avery companies for the full year, as compared with only four months in the previous year. The improved profits were derived largely from electronic tubes, cables, and the recovery in the fusegear and distribution equipment businesses.

English Electric Valve Company Ltd's sales, profit and order intake were all better than the previous year. Important orders were received for UHF klystrons for TV transmitters and tropospheric scatter communication links. Deliveries commenced on a new hydrogen thyratron with recognised superior technical qualities.

The M-O Valve Company Ltd also made higher sales and profit. Demand was down in medical electronics and audio amplifiers, but the surge arrester business continued to grow with the introduction to the market of new types. Demand for magnetrons and transmitting valves was sustained.

Marconi Electronic Devices Ltd was formed from the consolidation of AEI Semiconductors Ltd, GEC Semiconductors Ltd and the Microelectronic Division of Marconi Space and Defence Systems Ltd.

Solid state products for military applications were much in demand, but customer requirements for general industrial use fell. Major expansion was instituted of the

integrated circuit activities; a new manufacturing facility will come into use in 1981. The US based company, Circuit Technology Incorporated, was acquired to add to the group's capability in hybrid circuits.

W & T Avery Ltd had a poor year. Demand for weighing machines was lower at home and overseas, and competition intensified. Essential capacity and manning adjustments will have to be made. More energetic development of new products is being undertaken; the necessary direction and resources are being made available to Avery by GEC.

Avery Denison Ltd had a difficult year, but increased selling effort in overseas markets is beginning to show results.

Driver Southall Ltd benefited from the introduction of a new range of microprocessor controlled filling equipment, and progress will be made by a rationalisation of the manufacturing facilities.

Oertling Ltd was adversely affected by the economic situation and increased competition. Greater effort is required to secure more revenue from export orders and to develop new products.

Stanton Redcroft Ltd recorded higher sales and profits. New microprocessor-based products are being well received, and prospects seem brighter than for several of the Avery units.

Avery Hardoll Ltd had a more satisfactory trading result, turning from loss to profit.

Pump Maintenance Ltd produced better profit despite increased competition and postponement by the major oil companies of their plans to convert petrol pump indicators from gallons to litres. Prospects for the current year are more encouraging, especially with regard to metric conversion work.

GEC Measurements Ltd was affected by the downturn in the UK, particularly as a result of the low level of investment by the electricity supply authorities; loss of margin on this business could not be fully offset despite substantially higher export sales.

Satchwell Control Systems Ltd had a reasonably good year with higher profit. Orders for energy conservation projects more than compensated for lower demand from the construction industry.

Satchwell Sunvic Ltd suffered from the fall-off in demand for domestic central heating equipment because of fewer new housing starts and because of de-stocking by distributors. Capacity reductions and other cost savings have only just enabled the business to stay viable.

Operations in Nigeria have progressed well, and cable is being supplied and installed in 40 locations. Substantial quantities of optical fibre cables have been supplied to British Telecom for their new digital network, and installation techniques have proved satisfactory.

AEI Cables Ltd. Sales of power cables held up well throughout the year as a result of a steady demand from public sector users and higher demand for submarine and high voltage paper insulated cable.



A new Avery stainless steel digital platform scale being used in a wholesale fish market. Both the weigh platform and the microprocessor-controlled indicator are suitable for use in wet, dusty or similarly hostile environments. The scale is being sold to the food, chemical and pharmaceutical industries.

These sales offset the falling demand for cable from industrial users in the second half of the year. Exports of polyethylene compounds reached a record level but orders weakened in the last quarter, reflecting lower demand from France and Germany.

The performance of the general wiring cable business was maintained by increasing the proportion of rubber cable sales, particularly for export, against a fall in demand for plastic cables.

GEC-Henley Ltd had a much better year, with exports up by 30 per cent. The new products introduced during the last 18 months helped towards obtaining an improved share of a static home market, and the order book at the year end was satisfactory.

Salford Electrical Instruments Ltd received a record level of orders, and made record sales and profit. Investment continues to be directed towards cost reduction and product innovation.

Londex Ltd achieved rather higher profit on slightly lower sales.

Telephone Cables Ltd made improvements in sales and profit.

Wire Group. In bare and enamelled copper conductors, reduced volume severely affected the performance of the wire companies, particularly The London Electric Wire Company and Smiths Ltd. It was necessary to close production of winding wires at Leyton. Loading is being increased in the factories of FD Sims and Kent Electric Wire, and cost reductions are being achieved. Trading was also difficult at Vactite Ltd, although sales of specialised wires and cables remained strong.

Production of optical fibres was increased substantially, and new fibres continue to augment the production programme, including special designs for System X and for monomode transmission.

Substantial investment is being made in a continuous copper rod caster at Skelmersdale in partnership with Pirelli-General Cable Works Ltd. Production is planned to commence early in 1982.

GEC Fusegear Ltd's order input, sales and profit were badly affected by lower demand from end users and de-stocking by distributors. Short-time working was in operation for the last half of the year, and is expected to continue.

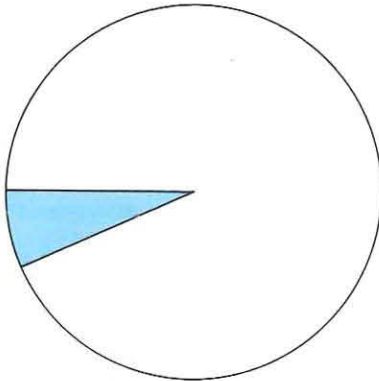
GEC Distribution Equipment Ltd's improved results flowed from the introduction of new products including the Class M80 range of power voltage switchgear.

Redring Electric Ltd increased turnover and was able to maintain profit. Higher sales of the newer products, such as the successful automatic electric kettle, 'Autoboil', contrasted with lower demand for components and equipment sold to industrial users. Productivity continues to benefit from capital expenditure on new equipment and from improved working methods.

Walsall Conduits Ltd and **GEC Walsall Ltd** had reduced sales and profit. The recession in the UK building and construction industries hit order intake. But demand from overseas improved.

A G Hackney & Company Ltd showed a small increase in sales, but profit was somewhat lower. There was a marked decrease in demand in the home market in the second half of the year but exports, particularly to Nigeria, kept the order book at a reasonable level.

CONSUMER PRODUCTS



13,000 Employees

	1981	1980
TURNOVER	£290m	£303m
EXPORT SALES	£26m	£26m
EXPORT ORDERS	£23m	£27m
PROFITS	£13m	£21m

The fall in profits, compared with the previous year, came largely from the furniture business. However, all the businesses, apart from television, were profitable.

Osram (GEC) Ltd maintained its profit although the UK lamps and lighting business remained generally depressed. In export markets, some useful street lighting contracts were won,



Osram (GEC) Ltd is now marketing the world's first 10 watt low pressure sodium lamp. It is used for security lighting and other applications. There is also an 18 watt version.

including those for the city of Riyadh in Saudi Arabia, and for the new Kuwait motorway. There is as yet little sign of improvement in trading conditions, but with the streamlining of its organisation and with a more intensive programme of product development, Osram's prospects are not discouraging.

GEC (Radio & Television) Ltd had another unsatisfactory year, although sales did improve in the second half. Wider distribution and the introduction of new products, including a video recorder, will enhance the prospects of a return to profitability.

Cannon Industries Ltd maintained its profit through higher manufacturing efficiency, helped by the installation of an advanced enamelling plant and the high level of commitment shown by the workforce despite short time working.

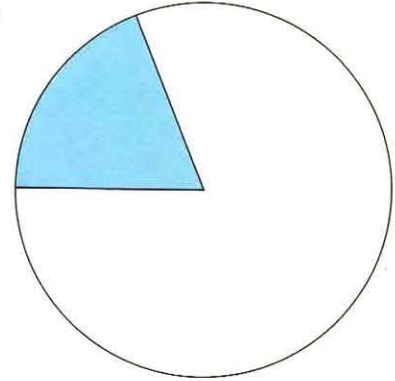
GEC-Xpelair Ltd reported lower profits on a maintained turnover with a larger proportion of business being derived from overseas markets. New and cost reduced products are being introduced which will help the business maintain its position in the market.

Hotpoint Ltd's sales for the year decreased a little. Early action taken to adjust production schedules to demand avoided distressed selling, and the profit for the full year was not unsatisfactory in the circumstances.

The new refrigerator plant at Peterborough worked to capacity, but the Morphy Richards small appliance division suffered from low demand. Production from the new washing machine factory in North Wales will commence later this year.

Schreiber Industries Ltd made a small profit on slightly lower sales. Poor market conditions made it necessary to cut back capacity and reduce the labour force. Demand is showing no real improvement, and further economies will be needed to enable the business to trade at positive margins.

OVERSEAS



36,000 Employees

	1981	1980
TURNOVER	£797m	£688m
PROFITS	£66m	£61m

The results shown for the overseas subsidiaries have been converted from the foreign currencies into sterling at the exchange rates ruling on 31st March. An assessment of the results should take into account the effect of sterling being generally a little stronger at the end of 1981 than it was at the end of 1980. The commentaries on the individual subsidiaries are based on the results in their respective local currencies.

EUROPE

	1981	1980
TURNOVER	£150m	£155m
PROFITS	£13m	£17m

Vynckier N V of Belgium and its subsidiaries in Germany, France and Holland were not able to maintain the level of profit achieved in the previous year. Business mainly in electrical installation materials was badly affected by the recession in the construction industry throughout Europe, particularly in Belgium where new building permits were 40 per cent down. Some reduction in employment levels has been necessary to reflect the effects of the recession and of Belgium's repressive price controls.

GEC Composants S A in France increased sales and profit by further developing its business in the oil, petro-chemical and nuclear industries, and electrical sub-station equipment. This was accomplished despite the

weaker franc which materially increased the cost of its products, sourced largely from the UK and the US.

Société des Moteurs Baudouin SA of Marseilles increased sales to traditional French export markets and to the Far East, but fared less well at home where stagnation of demand from the fishing industry and for industrial generator sets, coupled with increased competition from automotive type diesel engine builders with spare capacity, caused margins and profit to fall.

Marconi Italiana SpA again pushed sales and profit to new records notwithstanding a most difficult economic situation domestically and in export markets. The volume of sales for military applications increased, but this was partially offset by a decreased volume of civil business.

Norsk Marconi A/S countered recessionary conditions in Norway, but was helped by new products and further successes with major communication engineering projects in the North Sea oilfields.

GEC Distributors (Ireland) Ltd held its share of the electrical wholesale market which was affected by recession in all areas of business.

THE AMERICAS

	1981	1980
TURNOVER	£357m	£306m
PROFITS	£25m	£25m

A B Dick Company of Chicago achieved a small increase in sales but failed by a substantial margin to recover higher operating costs. There was a slackening of demand for the traditional offset printing, mimeograph and spirit equipment. In the newer products, such as word processors and microfiche systems, sales were ahead of the previous year but did not expand at the planned rate. Sales volume was also affected by technical problems on a factored copier introduced in early 1980. Reductions in manning have been made and further measures to increase efficiency will be taken.

Scriptomatic Inc, acquired by A B Dick in September 1980,

which manufactures addressing equipment, turned in satisfactory results.

Alco Power Inc enjoyed a further year of real growth in its diesel engine business, primarily by exports to Iraq, Brazil, Bangladesh and Pakistan. Profitability was increased by the continuing capital investment programme which is providing additional capacity with greater flexibility and efficiency. First production will be available in 1981 of the recently introduced dual-fuel and natural gas-fired engines, which are expected to constitute an important addition to Alco's product range.

Cincinnati Electronics Inc, which manufactures defence electronic equipment primarily for military communications, was acquired at the end of the financial year.

Circuit Technology Inc was acquired in November 1980. It manufactures and sells hybrid microcircuits, and its results since acquisition are in line with expectations.

Electrical Machinery Industrial Controls Corporation of Georgia has now been established as an acceptable supplier of medium voltage starters, and steady progress towards profitability is being made in this new venture. The Georgia factory has begun the manufacture of drives to provide variable speed control of synchronous motors, a product which offers a considerable potential for energy savings.

EEV Inc and EEV Canada Ltd, as distributors for the English Electric Valve Company in North American markets, increased sales of leddicons, UHF television klystrons and high power thytrons.

The English Electric Corporation, which is a general representational company for the US market for GEC companies, was awarded further rectifier traction sub-station contracts for the rapid transit authorities in San Francisco and Boston.

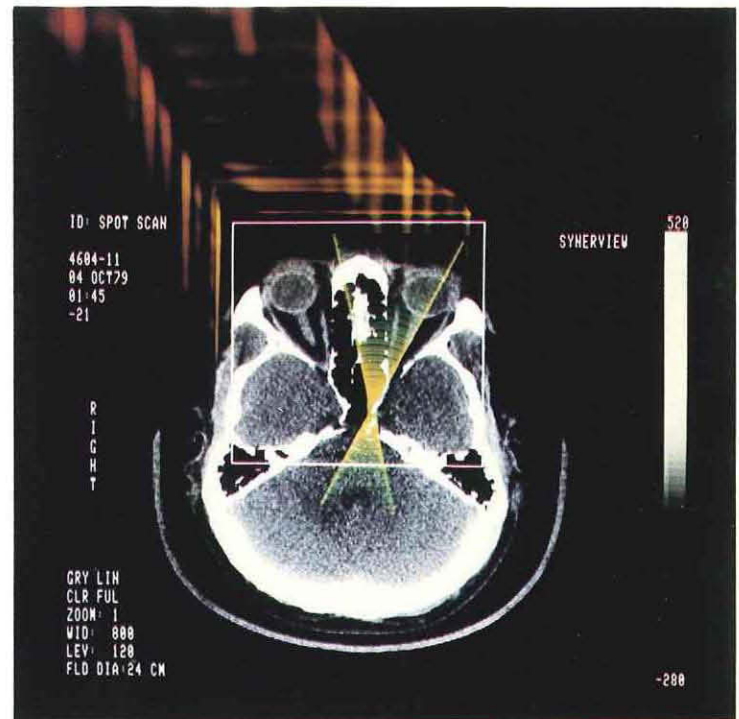
Marconi Avionics Inc, through greater participation in the production of head-up display equipment for the General Dynamics F-16 aircraft, achieved a useful increase in sales. Other avionics and test equipment was supplied for the McDonnell Douglas A-4M Skyhawk, the Bell

Helicopter Textron AH-1S Cobra, the Boeing 747, and the Vought A-7 Corsair. A capability for producing gas laser tubes has also been successfully established.

Marconi Electronics Inc increased both sales volume and profit. Orders were received for TV monitoring equipment and measuring instruments including the first order for automatic telephone fault monitoring equipment.

plants in Bedford and Ossining, USA, in West Germany, and the UK facility for the manufacture of patient and ambulatory monitoring systems, electrocardiographs, electroencephalographs and defibrillators.

Ruston Gas Turbines Inc had another record year. The recently extended facility at the Houston plant was fully utilised, producing integrated gas turbine driven pump, compressor and generator



A computer image generated by Picker International's tomographic scanner. It shows a cross section of a human skull at the level of the optic nerve.

Picker Corporation Inc was acquired at end March 1981. It is the second largest medical electronics business in the United States and its principal products embrace diagnostic imaging equipment including computerised tomography scanners, X-ray, ultrasound and nuclear medical equipment. Picker has major manufacturing plants in Cleveland and Northford, USA, in Canada and in West Germany.

Concurrently, the Picker Group was enlarged by the acquisition of GEC Medical Equipment Ltd, which manufactures X-ray and ultrasound equipment, and the medical divisions of Cambridge Instrument Company Ltd, with

packages for the Western Hemisphere, notably for Mexico and Alaska.

AEI Telecommunications (Canada) Ltd's sales and profit were maintained at the low level of the previous year. There is an encouraging up-trend in orders for equipment designed and produced by the company in Canada, and it has recently obtained its largest single export order.

Canadian Marconi Company reported better sales and profit after strong acceleration in the second half of the year derived from the continued growth in exports of the company's products in the civil and military fields. A new product, Deltaplex, was successfully launched during the year with substantial orders from Middle East and Far East countries. This equipment, which

fits well into the company's range of products, is a multiplexer for digital transmissions providing 15 channels as a single unit but capable of 63 channels in a combined form.

GEC Canada Ltd and Eastern Electric Company Ltd are being integrated into a single operating structure to allow more effective and economic use to be made of the companies' individual product and regional strengths. Both companies were affected by the strength of sterling against a rather weak Canadian dollar, but by the end of the year margins were beginning to improve.

GEC Diesels Inc's performance in Canada reflected the high order intake of the previous year and a reasonable level of business in the mining and marine sectors. But prospects have been adversely affected by delays in the placing of orders for a number of major projects.

AUSTRALASIA

	1981	1980
TURNOVER	£136m	£99m
PROFITS	£10m	£6m

GEC Australia Ltd benefited from a buoyant Australian economy. All divisions contributed to the improvement with the exception of the Lamps & Lighting Division where business has been severely affected by low-priced imports, especially of fluorescent tubes from Canada. After some years of unsatisfactory results, the Electrical Wholesale Division again became a profit earner, although it has yet to provide an adequate return on its capital employed. The Industrial Products Division showed impressive growth, selling more UK products as well as its own production. The Projects Division continued to expand at a rate restricted primarily by a shortage of engineers with the necessary skills. Order intake for the Heavy Engineering Division included transformers of 390MVA, the largest yet to be tackled at the Brisbane factory.

Avery Australia Ltd showed improvement with higher sales and profit.

GEC Diesels Australia Ltd again recorded improved results, helped by more business with the Armed Services.

GEC (New Zealand) Ltd increased sales and profit, despite unfavourable market conditions. There was a good level of sales of equipment from UK units of GEC and of locally manufactured products, particularly switchgear, telephones and new lighting introductions.



ASIA

	1981	1980
TURNOVER	£126m	£109m
PROFITS	£13m	£10m

The General Electric Company of India Ltd, with more new products and good results from the Motors and Pumps Division and the Genelec subsidiary, performed moderately well but did not achieve its potential. This was due to industrial relations problems associated with the need to raise productivity; the Transformer & Switchgear Division was the most affected. By the year end, there was evidence of greater co-operation from labour on production issues which, if maintained, should lead to better performance.

The English Electric Company of India Ltd, with a strengthened management team, had a further year of solid growth in its principal activities in fusegear, protection relays and control panels. With the new factory in Tamil Nadu coming on stream, it will now be possible to give

better service to customers through quicker deliveries.

The General Electric Company of Bangladesh Ltd continues to trade satisfactorily in its locally manufactured products while giving effective support to UK units in pursuit of equipment and project business.

Dacca International Airport where The General Electric Company of Bangladesh Ltd and GEC Electrical Projects Ltd have completed a contract worth over £1 million. The two GEC companies supplied, installed and commissioned all the runway, taxiway, approach, apron and general lighting systems and the visual landing aid systems.

Johnson & Phillips (Pakistan) Ltd's results showed little change on the previous year. In common with the rest of the economy, the market for switchgear and transformers was depressed, but programmes of product development and cost reduction, together with an important order from Sri Lanka, will enable the company to resist the worst effects of the down-turn.

The General Electric Company of Hong Kong Ltd had an exceptional and record year in which a substantial volume of engineering project work was completed. The peak activity in the project field has been passed

and additional effort is now being focused on achieving improvements in efficiency and market penetration in the general trading and electrical contracts activities.

The General Electric Company of Malaysia Sdn BHD gave important assistance to UK and other units of GEC in obtaining business in Malaysia, particularly in communications equipment and diesel engines, while improving its own trading results. The company is responding to the need to add local content, and is currently building a workshop for the overhaul and servicing of the many Ruston and Paxman diesel engines in use in the country.

The General Electric Company of Singapore Private Ltd had a better year, but it is not yet obtaining the margins required to produce an adequate return.

AFRICA

	1981	1980
TURNOVER	£28m	£19m
PROFITS	£5m	£3m

L H Marthinusen Ltd increased its turnover and profit but progress was retarded by the shortage of skilled artisans needed for its electrical machines and transformer repair business. Overseas recruitment is helping to cure this problem.

South African Scale Co (Pty) Ltd's results benefited from higher volume in sales and orders.

GEC Zambia Ltd, in a year in which the shortage of foreign exchange became even more severe and imports were extremely difficult to secure, was able to maintain sales and profit, but the outlook is uncertain.

GEC Zimbabwe (Pvt) Ltd increased its trading both in imported and locally manufactured goods, and improved its profit. The ending of the emergency and economic sanctions has been followed by a general uplift in demand. The progress of the company is still constrained by the scarcity of import licences but it is active in helping the UK units to re-establish their market positions in Zimbabwe.

ASSOCIATED**COMPANIES UK**

	1981	1980
TURNOVER	£142m	£116m
PROFITS	£1m	£3m

The figures given above show the GEC share calculated by reference to the GEC interest in the equity of the Associated Companies.

GEC-Hitachi Television Ltd improved its performance and the results before interest charges were much better. Higher standards of product quality and reliability were achieved in parallel with improvements in manufacturing efficiency. Order intake continues to rise, and prospects are brighter for the new financial year.

National Nuclear Corporation Ltd continued construction of the existing Advanced Gas Cooled Reactor (AGR) stations, fuel loading having commenced at Hartlepool and will shortly be undertaken at Heysham and Dungeness. Following protracted negotiations with the UK Generating Boards, arrangements have been agreed for the next two AGR stations at Heysham and Torness, under which the Corporation is the prime contractor for the design and management of construction of the nuclear islands, and will act on behalf of the customers in letting contracts for plant supply and erection. Design work continues on the Pressurised Water Reactor and the Commercial Fast Reactor.

Ruston-Bucyrus Ltd had an extremely bad year with lower sales and a trading loss, partly because of the decline in quarrying and mining machinery business and the very depressed market for construction machinery. Intense competition and the rate of exchange made export business very unrewarding.

Lamp Component Companies had a very difficult year and failed to respond quickly enough to the many adverse factors with which they were faced. The steps now being taken to place the company on a more economically viable footing are bringing improved

results, even though demand in the UK is low and the strength of sterling has reduced competitiveness in export markets.



Deflection yokes being adjusted at GEC-Hitachi Television Ltd. The television sets seen in the picture are part of the test equipment.

Division's performance was much more satisfactory due to high sales in the Americas and to the strength of the German installation business.

Cable Makers Australia (Pty) Ltd again achieved higher sales and profit.

GEC South Africa (Pty) Ltd experienced another year of expansion in favourable market conditions, but the effect of a high inflation rate and shortage of skilled personnel curbed profit growth. The Engineering Group participated with GEC UK units in winning major contracts in the fields of power generation, mine-winder electrics and railway traction and signalling. The Machines Group increased output of ac motors, traction equipment and foundry products and is expanding its facilities. The Power Group was affected by poor results in the transformer business. But the locally developed vacuum switchgear and a successful entry into African township electrification work in Soweto have made prospects brighter. The AEI Henley subsidiary made good progress in its private telephone exchange activity, and Satchwell Controls, which completed a new factory extension, reported improved results.

Telephone Manufacturers of South Africa (Pty) Ltd made substantially increased sales of switching equipment and telephones to the South African

Post Office and embarked on the first phase of manufacture of a digital switching system.

African Cables Ltd improved sales and profit, and have now begun manufacture of high voltage cross-linked polythene cable.

African Telephone Cables (Pty) Ltd had a good year; the level of demand continues to be satisfactory.

Winding Wires (Pty) Ltd performed well in the face of increasing competition.

Avery India Ltd secured increased orders, higher sales and record profit in the year, despite continuing power shortages and transport problems.

RESEARCH

Work of broad relevance to many operating units is carried out in four central research laboratories which work very closely with the operating units' own laboratories and staff.

Materials. Materials influence product design, performance and cost. For this reason the research laboratories engage in many areas of materials science, for example, the use of lasers to control chemical reactions and in material processing.

Glass ceramics which are both transparent and possess almost zero thermal expansion have been prepared for laser applications such as the laser gyroscope.

Semiconductor materials are increasingly important in the Company's products and research is carried out on the growth of single crystal films of silicon, gallium arsenide and other materials.

It is important that research on materials is supported with improved techniques for material diagnostics, and to the existing armoury including optical and infra-red spectroscopy, X-ray crystallography and electron microscopy has been added a new facility for surface analysis which includes X-ray induced photoelectron spectroscopy.

Silicon Integrated Circuits. The importance of this pervasive technology has been reflected in

ASSOCIATED**COMPANIES OVERSEAS**

	1981	1980
TURNOVER	£279m	£227m
PROFITS	£30m	£24m

The figures given above show the GEC share calculated by reference to the GEC interest in the equity of the Associated Companies.

SRA Communications AB experienced difficult trading conditions in Sweden, Denmark and Norway with severe pressure on margins, but substantial orders obtained in the Middle East resulted in a record order book scheduled for delivery in the coming year.

Fisher Controls International Inc reported higher sales and profit well ahead of the previous year. Although demand for control valves fell in Europe, increased orders were received from other territories, particularly North America. The Instrumentation

the expansion of the company's related research efforts.

Progress in silicon device technology makes possible the manufacture of silicon chips containing about 100,000 transistors. This provides an opportunity to create new digital systems whose structure – or 'architecture' – departs from the classical computer, thus giving better solutions to many system needs.

The design of such complex new products requires improved computer aids. Research on improved computer-aided design (CAD) is under way and existing CAD packages such as CELLMOS, HARTRAN, and PETULA, developed in Company laboratories form a solid foundation on which to build more comprehensive CAD for the future.

Work is in hand on the competitive silicon process technology on which new designs are to be implemented, with particular emphasis on advanced Very Large Scale Integration (VLSI) processes including Complementary MOS technology on both bulk silicon and sapphire substrates. Research is under way on high performance bipolar technology and on the use of electron beam microfabrication to make even smaller devices for the fastest possible switching circuits.

Sensors/Transducers. Silicon technology has its place in sensor research including charge coupled devices (CCD's) for solid state imaging, and in humidity and gas detection and measurement. Many materials and devices are significant in the total range of sensors of interest. The measurement of temperature, pressure, and flow is an essential part of many control systems. Typical research is on a piezo-electric flexible plastic film as a movement indicator or as an ultrasonic transducer in underwater and non-destructive testing applications.

Research on optically-activated sensors continues for the measurement of temperature, vibration, electric current and voltage.

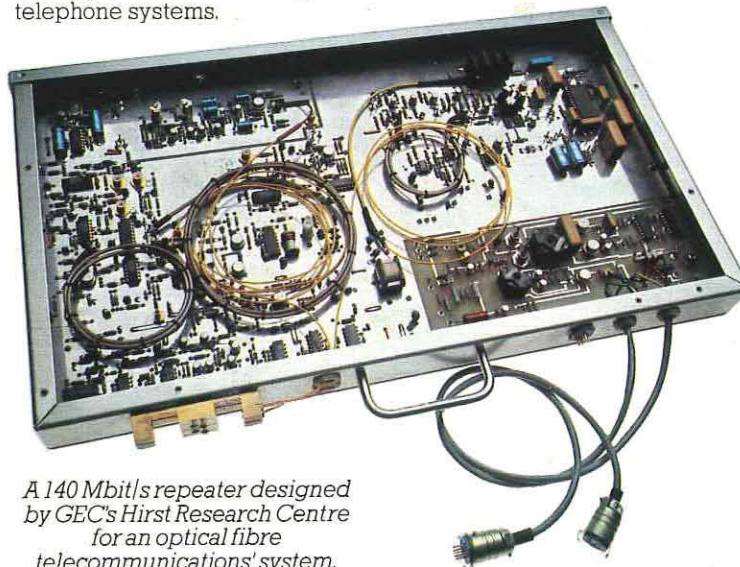
Optoelectronics research includes the application of liquid crystals, light emitting diodes and electrochromic materials in displays.

Infra-red research embraces work on materials for detectors and lenses through to systems

research to aid the identification of information within a picture.

Signal and Image Processing. To use the output from sensors efficiently it is necessary to carry out signal conditioning and processing. The techniques being worked upon are relevant to medical diagnostics, telecommunications, radar, sonar, and improved manufacturing and inspection methods (eg robotics).

Work on speech processing is leading to more efficient digital telephone systems.



A 140 Mbit/s repeater designed by GEC's Hirst Research Centre for an optical fibre telecommunications' system. GEC Telecommunications is supplying the 140 Mbit/s link between London and Reading, the first stage in British Telecom's nationwide optical fibre trunk telephone network. Initially support has been provided from the research centre in the form of optical terminals and repeaters with associated electronics.

Optical and ultra-sonic techniques are being combined in a new form of spread spectrum receiver in which the information to be analysed is converted into an ultra-sonic signal which is propagated through an optically transparent medium; it modulates laser light passing through the same medium, the light being subsequently re-converted to an electronic signal.

Our research on medical diagnostics, using both ultrasound and nuclear magnetic resonance, frequently produces images which need skilled medical interpretation. Image processing, removing unwanted parts of the image, enhancing edges and adding colour variation aids this interpretation.

Communications. Much of the research programme in communications is aimed at a combination of better utilisation of existing bandwidth allocation, extending the available bandwidth, and achieving the efficient combination of speech and data transmission in a single communication system.

Research on all aspects of optical fibre based transmission systems continues, with the company's full participation in British Telecom's installations.

Important new research is concerned with the variety of networks envisaged for use in inter-connected office and factory systems. The company's knowledge in telecommunications, office equipment and computers provides the backcloth to this important research area which embraces the interface between terrestrial networks and satellite-based long-haul communication systems.

Energy. Energy conversion and conservation continue to be major areas of research.

The future importance of fluidised bed combustion of coal has stimulated research on gas cleaning and laser particle analysis.

Renewable energy resources are receiving increased attention. The company participates in the development of 250 kW and 3MW aerogenerators for installation on Orkney, with particular attention to the control systems.

Feasibility studies are in hand on other non-conventional energy conversion systems, such as

solar-driven organic Rankine cycles for power generation in remote locations; large diesel-driven heat pumps for industrial applications; domestic heat storage devices; and various combined heat and power schemes, including district heating.

Incremental but important improvements continue to be made to conventional turbo machinery and its associated power generation and transmission equipment. Higher operating temperatures place new demands on materials and call for improved design methods.

Design and Manufacturing Methods. The above research topics will provide a range of competitive new products. Equally important is research to improve design and manufacturing methods.

The use and development of advanced computer techniques in such areas as aerodynamics, heat transfer, fluid mechanics, vibration control and stress analysis are actively pursued.

Finite-element techniques combined with an inter-active graphics system are used to predict magnetic and electric fields in two and three dimensional structures and time-varying systems such as electric motors, generators and power transformers.

Research is being carried out on software for mechanical design and analysis; for electronic circuit design, simulation and testing; for reliability prediction and failure mode analysis.

The use of robots and their sensing systems where manufacturing process and products change relatively quickly (as applies to most of the capital electronics industry) is being actively studied.

Longer Range Research. A Long Range Research Laboratory has been formed whose purpose is to participate in and exploit current scientific research on topics which could be of importance in the longer term (1990's). Attention is concentrated on molecular electronics, electron beam-plasma interactions (the 'free electron laser') and the process of perception.

In these topics – as indeed in much of the company's research – close collaboration is being developed with leading University research groups.