

THE
MARCONI
COMPANY

This book is intended to introduce the work of The Marconi Company and to give the reader some idea of the scope of the Company's activities.

It is not intended to be exhaustive in the treatment of any subject, but rather to indicate a general pattern, and to provide openings for further enquiries.

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BACKGROUND TO THE MARCONI COMPANY

The history of The Marconi Company is inseparable from the history of radio itself. In 1896, Guglielmo Marconi, a young man of 22, arrived in England and was granted the first patent for his method of telegraphic communication without wires. In the following year, he founded the world's first radio company to develop his great discovery on a commercial basis. This Company was called the Wireless Telegraph & Signal Company Limited and was renamed Marconi's Wireless Telegraph Company Limited three years later.

The early years of this Company were crowded with events of vital significance. Wireless transmission over a range of 8 miles with sufficient strength to operate a standard Post Office type recorder at the receiving end was first achieved in 1897. This was followed later in the same year by the establishment of the world's first permanent wireless transmission station on the Isle of Wight. From this station the first paid Marconigram and the first radio transmission to a ship at sea were sent.

December 12th, 1901 saw the greatest triumph of all, when faint signals transmitted from Poldhu in Cornwall, England, were picked up by Marconi and his team of engineers, at St. John's, Newfoundland. With the spanning of the Atlantic by wireless, the future of world-wide radio communication was assured.

In 1900 The Marconi International Marine Communication Company Limited was created as a separate company in order to control the maritime operation of wireless, to which much of the effort in early years had been directed. This Company still exists today, as The Marconi International Marine Company, and the name of Marconi is a household word throughout the seven seas.

Until 1928, The Marconi Company was engaged not only in the development and manufacture of every type of apparatus concerned with the industry, but also in the establishment and operation of a world-wide network of international wireless telegraph services. 'Via Marconi' and 'Marconigram' were part of the English language at this period.

With the advent of the Marconi short wave system for long distance communications, came the fear that the

submarine cables of the Commonwealth might eventually become unprofitable. This situation was met by the amalgamation of the cable companies and Marconi's wireless operating interests into one company known as Cable and Wireless Limited. This company was later nationalized in 1946. The Marconi Company meanwhile continued to concentrate on the development and manufacture of wireless equipment. Shortly after the Second World War, The Marconi Company became a member of English Electric, but the title of Marconi's original company remained unchanged until 1963, when it was altered to 'The Marconi Company Limited'.

Marconi has a long and distinguished record of achievements in radio and electronics. The Company fitted the first ship with wireless as well as the first lifeboat, the first lighthouse and the first lightship. The first airborne wireless set flew in 1910 - a Marconi spark transmitter - and by 1920 the Company had offered the first commercial design for an airport direction finding station. In 1920 also, the first advertised radio programme was broadcast by Dame Nellie Melba from the Marconi Works at Chelmsford, England, and when the world's first public television service was opened in 1936, the system was jointly produced by Marconi and E.M.I.

THE COMPANY TODAY

In the increasing atmosphere of specialization in the electronics industry today, The Marconi Company remains one of the very few which still covers the entire range of radio applications. The Company is also unusual in that it is concerned only in the capital equipment market and has no domestic outlets whatsoever. It is, in fact, the largest exporter of capital electronic equipment in the United Kingdom.

A very important part of the Marconi philosophy is the view that the sale of equipment of any type must be accompanied by an ability to offer comprehensive auxiliary services to the customer, both before and after the sale. For this reason, Marconi maintains a very wide range of survey, planning, installation and maintenance units in all of its Product Divisions. A comparatively large proportion of contracts undertaken by the Company depends upon the ability to supply these services, and on very few occasions does a Marconi contract consist simply of the supply of hardware in boxes.

The Company has made a particular speciality of 'turnkey' projects. Here the customer defines the particular service that he requires, such as an international telecommunications centre or a television service, and is then relieved of the need to take further action until the project is complete and he can move into the new buildings and take over a fully equipped and staffed, operational entity.

Another part of the Marconi philosophy is centred on research and development. The Marconi Company has, since its foundation, directed great efforts towards technical advances, in the certain knowledge that only by constantly pressing forwards can it remain in the van of the electronics industry. To this end, the Company maintains one of the most advanced research and development establishments of its kind in Europe.

Considerable emphasis has always been placed on education. Marconi College, founded in 1901, was the first radio college in the world, and this unique establishment still exists today in a greatly expanded form. Instruction is given at post-graduate level to the Company's own student engineers and, in addition, training in the operation and

maintenance of Marconi equipment is given to personnel nominated by customers.

Training schemes exist within the Company for apprentices of all types and over 1000 are currently under training in the various Company establishments. The quality of these schemes is borne out each year by the regular successes of Marconi apprentices at the annual competitions held by the Physical Society.

MARCONI AVIONICS

Airborne communication and navigational aids, radar and automated air traffic control and defence systems.

Airborne Systems

The design and development of airborne communication and navigation systems for civil and military aircraft and hovercraft is the responsibility of the Marconi Aeronautical Division. The Division's Sixty Series of transistorized equipment is the most advanced of its type in the world. This series was created with reliability as the principal objective, and as a result of a major programme of investigation into the causes of equipment failure, a number of highly specialized design techniques have been incorporated. The increased equipment reliability is especially important in the new generation of airliners for reasons of both safety and the necessity of maintaining high utilization. New automatic landing systems are making great demands on equipment reliability. The ILS components of the Sixty Series already fulfil all the requirements of automatic landing which have so far been defined and have been put to practical use in the automatic landing systems in the BEA Trident and the BOAC VC10.

The Sixty Series includes v.h.f. communication and navigation equipment, an automatic direction finder with crystal controlled switch tuning, and h.f. communication equipment providing double or single sideband operation. The Doppler Navigator is also represented in the Sixty Series, together with an airborne navigation computer designed to operate from doppler-derived information. The most recent addition to the range is an automatic direction finder which is completely solid-state and has no moving parts whatsoever. Mechanical switching and capacitors have been eliminated and all tuning is effected using solid-state circuits.

Doppler navigation equipment, which was pioneered by Marconi in 1951 and which is now accepted by many airlines and military authorities as an essential primary navigation aid, has also been introduced for helicopters. Extremely accurate measurements of horizontal and vertical velocities and precise height readings are given by this equipment.

The Marconi Company has sold civil and military airborne electronic equipment to practically every country in the world. The Sixty Series has been specified by a number of leading world airlines, and the British Ministry of Aviation has already purchased several million pounds worth of these equipments for use by the Royal Air Force. A supersonic version of the Sixty Series Doppler Navigator has been chosen for the prototypes of the Anglo/French Concord, just as a supersonic version of the previous generation of Marconi's Doppler Navigator and computer was chosen for the French Air Force Mirage IV bomber and Mirage IIIE strike fighter.

Technical assistance to operators has been an important constituent of the Marconi service to aviation since the earliest days of airborne radio. Today, the Company maintains a large system planning group which is available to advise aircraft manufacturers and operators during all the stages of engineering a new system into an aircraft. Comprehensive after-sales service facilities are also available. The principal service depot is located at London Airport, Heathrow, where a staff of engineers is always available to provide rapid servicing for the Company's equipment, and where Marconi offers a unique service whereby any airline or executive aircraft operator can hire replacement units while his own are being repaired.

Marconi demonstrated the first practical use of microminiaturization techniques in airborne equipment with an experimental model of the Sixty Series airborne marker receiver. These techniques lead to a dramatic increase in reliability in addition to reductions in size and weight, and will almost certainly form the basis of the next generation of airborne radio equipment. Development is in progress covering microminiaturized v.h.f. communication/navigation equipment, a combined v.h.f./h.f. transceiver for light aircraft, and a digital computer, which incorporates advanced microelectronic circuits.

Marconi's Electro-Optical Systems Division also plays an important role in avionics. In association with Hawker Siddeley Dynamics Ltd., Marconi is responsible for the development of the Television Guidance System for the Anglo-French air-to-surface missile, MARTEL. MARTEL represents a great advance on any missile known to exist elsewhere in the world.

Marconi's closed-circuit television cameras have been used by the Vickers VC10 and the BAC One-Eleven during flight trials, when they facilitated inspection of external control surfaces during flight.

Ground Systems

Ground systems for aeronautical use are handled by the Company's Radar Division, which forms what is almost certainly the largest and most comprehensive ground radar organization in this country and which manufactures a wider range of equipment than anyone else in the world.

The Division is the U.K.'s largest single exporter of civil and military radar equipment, with over two-thirds of its total production going overseas.

An important part of Radar Division's capability is the planning and installation of complete civil and military systems. The Company is responsible for more than seventy military defence systems throughout the world. It was entrusted with the re-equipment of the entire radar defence of Great Britain and a large part of the N.A.T.O. defences in Europe. Now, it is the sole U.K. member of NADGECO, the international consortium which is to deploy the latest technology in data generation, data handling and data display to weld the entire N.A.T.O. defence network into a single coordinated machine. Marconi has equipped over forty airports in thirty-three countries with Air Traffic Control Systems and has been awarded the contract for installing a massive, computer-controlled Flight Plan Processing System in the new London Air Traffic Control Centre.

When undertaking such projects, Marconi is able to draw upon its own vast range of advanced equipment for data generation, handling and display.

Data Generation

Marconi radars are suitable for a wide variety of civil and military applications. For example, in Air Traffic Control they are used for terminal area, airways surveillance, upper air space etc; and in the military field they are used in systems ranging from the simplest early warning to the most sophisticated air defence centre.

Primary radars can be provided at 50cm, 23cm, 10cm and 3cm wavelengths, and a back-to-back combination of 10cm and 23cm radars on a single aerial head is also available. The Company also produces a v.h.f. direction finder which provides, in the simplest and least expensive form, the direction finding facilities normally required at a small airport.

The 50cm wavelength radar equipment has been developed by Marconi to provide the best combination of range and freedom from clutter, with high definition and good low-level cover. This single equipment can provide not only the accuracy necessary for terminal area coverage, but also ranges in excess of 150 miles, suitable for airways surveillance work. Marconi's 50cm radar brings with it the advantages of crystal frequency control, simplicity and reliability. A parametric amplifier has been developed which considerably increases the sensitivity of the receiver and gives a range improvement of up to 40% at very low cost. The device is fitted to all 50cm radar and is being developed for use with all other radar wavelengths. A full range of ancillary equipment is available including fully coherent MTI, a staggered PRF system to eliminate blind speeds and an anti-clutter device, also based on PRF discrimination.

The Company is engaged on a study of methods of radar pulse compression. This technique, which utilizes a variable frequency transmitted radar pulse with a delay line in the receiver, produces high discrimination at long ranges using lower power equipment, instead of the high power, short pulse transmitters which would otherwise be necessary. Marconi is the only manufacturer of 50cm radar in the world and has installed over 50 in 16 countries, including the U.K., where, with one single exception, they cover the whole of the modernized airways radar system.

A secondary radar system, SECAR, has been developed jointly by Marconi and Compagnie Française Thompson Houston-Hotchkiss Brandt. It is fully transistorized except for the high power output stages, and employs a number of new techniques, including an entirely new aerial switching system patented by The Marconi Company. All civil and military modes of operation, and all present and foreseeable requirements of ICAO and Eurocontrol are accommodated in this system.

Data Handling

Time is a powerful enemy of present-day air defence operations and of civil air traffic control. In defence, it is necessary to perform a number of operations to acquire the target and establish identity before deciding on the most effective form of interception and then to bring the weapons into operation and direct them onto the target. Because of the velocity of the offensive weapons, all these operations must be carried out at a speed beyond human capability. In the same way, it is becoming increasingly difficult to control present-day civil air traffic, owing to growing congestion in the air lanes and the increasing speeds of jet aircraft. Automation provides the answer to these problems, and Marconi leads the world in the application of computers to military defence and air traffic control radar.

The Company developed the high-capacity, high-speed, real-time digital computer, MYRIAD, specifically for this purpose. Three MYRIAD machines, which are briefly described elsewhere in this book, are to be used in the London Air Traffic Control Centre's new Flight Plan Processing System.

Data Display

New transistorized displays are available for all types of civil and military applications, and an extensive range of inter-console markings, video maps and alpha-numeric identification symbols can be provided to fulfil any operational requirements. These symbols are 'written' on the cathode-ray tube face by the electron beam in the radar inter-scan period, using a separate high-speed deflection system.

This principle of 'writing' on a cathode-ray tube was first exploited by the Company, and has been extended to provide an extremely flexible alpha-numeric tabular display. Ideally suited to display air traffic control data, particularly in conjunction with computer processing systems, this display is now also finding applications in a wide variety of industrial situations.

Another display system, which has been developed by The Marconi Company, is designed to operate in daylight. The 5-in and 11-in displays use a direct view storage tube, developed for this work by The English Electric Valve Company. A normal radar picture can be displayed on the face of this tube with a brightness sufficiently high to make it clearly visible in bright sunlight. The degree of persistence can be varied to give the required afterglow period and all the characteristics of a normal radar display can be reproduced very simply. This type of display avoids the complication and lack of flexibility experienced with scan conversion, but can be used in daylight situations such as airfield control towers or the bridges of ships, without the need for cumbersome masks or special lighting. Marconi's 5-in Bright Displays are being used to form the basis of Distance from Threshold Indicators and 36 have been sold.

An advanced type of display developed by The Marconi Company is the 'touch' display which has a matrix of very fine wires embedded in the lower half of the display face plate. These displays will be used widely throughout the London Air Traffic Control Centre's computer-controlled Flight Plan Processing System. The computer writes details of the traffic on the tube in such a way that those items which the controller may wish to modify, or about which he may require more information, coincide with the touchwires. The controller can then request information from the computer, or

modify the flight plans or make decisions by simply touching the relevant item on the display.

Data Transmission

Civil and military radars are generally sited at some distance from the control centres and The Marconi Company has for some years been engaged in the development and manufacture of wideband microwave radar links for the transmission of radar data over long distances. One example of the use of this equipment is the U.K. Airways Radar System where Marconi links are used to connect the radar sites with both the Northern and Southern Air Traffic Control Centres. Marconi-data is a point-to-point data transmission line equipment.

To complete major projects Marconi's communications and closed-circuit television equipment is frequently used. Marconi closed-circuit television made a notable contribution to the flight data display system at the Southern Air Traffic Control Centre where, at the touch of a button, twenty-four television cameras present radar controllers with a wide range of essential information from a variety of sources.

MARCONI BROADCASTING AND TELEVISION

The Marconi Company is by far the largest manufacturer of professional television and sound broadcasting equipment in the United Kingdom. The Company is the largest exporter of this type of equipment in the United Kingdom and probably also in the world. Marconi Broadcasting Division, which exports more than three-quarters of its entire production, has supplied eighty-eight countries during the past five years.

Sound Broadcasting

The Marconi Company has been a world leader in this particular field since the beginning of broadcasting. The first advertised radio programme in the world was broadcast by Dame Nellie Melba from the Marconi works in Chelmsford in 1920, and the famous station 2LO was designed and built and then operated by the Company from May 1922 until the formation of the British Broadcasting Company in December of that year. Since those early days, Marconi has continued to supply a large proportion of the world's broadcasting equipment. Over three hundred transmitting stations have been supplied to other countries to date and well over half the sound transmitters operated by the BBC in this country are Marconi made. The Marconi Company also provided 13 of the 19 transmitting stations forming the first phase of the BBC VHF Network, which opened in 1955 after a lengthy period of experimental broadcasting from a station equipped by Marconi. Since then, a large proportion of the satellite stations have also been provided by the Company. Similar v.h.f. equipment has since been supplied to Italy, Sweden, Norway, Australia, Cyprus, Denmark, Hong Kong, Libya, Malta, Poland and Venezuela.

In short wave broadcasting, Marconi has introduced a high power transmitter. Operating at 250kW, it incorporates a very advanced modulation technique which increases the intelligibility in conditions of noise or interference. Twenty-eight of these transmitters have now been ordered, and at least twenty-two of them are already in operation, including six at the 'Voice of America' relay station at Woofferton, in England.

Marconi's new range of m.f. broadcasting transmitters includes 1kW and 10kW designs employing the latest solid-state techniques throughout, except for a single valve in the

final stage. Transistorization has not only reduced the cost, size and weight of the transmitter but has considerably improved the operational reliability and stability. Simplified operation is another feature of this advanced equipment which is expected to make a significant contribution to Marconi's export effort.

Television Studio Equipment

By far the most easily recognizable item of television studio equipment is the television camera. Marconi's latest range of three transistorized cameras, the Mark V, Mark VI and Mark VII, fulfil every need in the modern broadcasting system.

The Mark V is Marconi's latest version of the 4½-in image orthicon camera - a type pioneered by the Company fifteen years ago, for which it received one of America's leading television technical awards. Marconi's 4½-in image orthicon cameras are world leaders. Over 1,300 have been sold throughout the world, of which a quarter have gone to the U.S.A. The Mark V is the smallest and lightest 4½-in image orthicon camera in production anywhere in the world. It is also the simplest to operate.

Marconi's Mark VI provides the ultimate in performance from a photoconductive black-and-white television camera. The basic unit is designed for telecine operation and can be built up into a studio or outside broadcast camera, using a number of additional units and changing one type of photoconductive tube for another. The particular feature of the Mark VI is its very high sensitivity. Perfect pictures can be obtained at less than 50-ft candles - lower than half the light level of a normal black-and-white studio.

The Mark VII four-tube, separate luminance colour camera is without doubt the most advanced in the world. The Company has maintained a continuous programme of development over many years and its colour cameras have been used experimentally by the BBC since 1954. This latest version has a remarkable degree of sensitivity and produces perfect pictures in light levels acceptable in any black-and-white studio. In a matter of months after its introduction, Marconi had over 250 orders and firm reservations for the Mark VII, more than 70 per cent of them from the United States.

The Company also produces a very full range of other television and sound studio equipment. Of particular note is the range of sound and vision mixing units. Modular construction is employed throughout, making it possible to build up any particular range of facilities.

Marconi Broadcasting Division is also active in supplying outside broadcasting equipment and services. Not only is the Company a major manufacturer of fully equipped television outside broadcast vehicles, but the Television Demonstration Unit, primarily intended to give world-wide demonstrations of Marconi television equipment, also functions as a comprehensive outside broadcast unit and is available for hire. This unit can be fitted with eight Mark V black-and-white cameras or six Mark VII colour cameras.

Television Transmitting Equipment

The Marconi Company was very closely associated with the development of television in the early 1930s, and was jointly responsible, with E.M.I., for the world's first public television service in 1936. Since then, the Company has supplied transmission systems to 30 countries throughout the world. The u.h.f. band is being used increasingly and Marconi u.h.f. transmitters have already been sold to Sweden, Denmark, the U.S.A. and Britain. The order from Television Chicago was Britain's first for television transmitters from the U.S.A. The BBC orders also called for a number of wide-band u.h.f. aerials. These new aerials, which are contained in glass fibre cylinders, have been especially developed by the Company for this type of application, and they will handle, without any modification, up to three additional programme channels. The transmitters have been designed specifically to cater for all the requirements of future colour television services, and incorporate unique techniques patented by the Company.

The Marconi Company is singularly equipped to handle complete projects - from microphone and camera, through the entire system to the masts and aerial system; and from the foundations of the building to the furnishings and decorations.

Closed-Circuit Television

The Marconi Company first became concerned with closed-circuit television in 1951 and a separate Division was created in 1958. The Company is now the largest British exporter of closed-circuit television, and has sold systems to more than twenty-six countries.

The present product range of CCTV equipment has evolved from years of experience gained in the engineering of systems. It has been designed for maximum operational simplicity and long-term stability. These two attributes are inherent in all Marconi camera channels and have set world standards. They

are the result of transistorization and the use of automatic circuits controlling sensitivity and picture black-level - a Marconi patented feature.

A self-contained transistorized vidicon camera has been designed to meet the needs of educational television, and systems based on this camera have been installed in over thirty schools, teacher training colleges and universities in this country and abroad. It is also equally suitable for numerous small studio and other closed-circuit applications. The camera has two versions, one with a single lens and the other with a built-in view finder and 4-lens turret. The cameras are extremely simple, the only operational controls being the ON/OFF switch and lens focus.

Marconi industrial vidicon cameras are used in many applications throughout this country and the rest of the world. Designed for use under the most arduous conditions, these completely dust sealed cameras combine high picture quality with the ability to withstand severe shock and wide variations in temperature and humidity. Stability has been developed to a point where adjustment is not needed between changes of the Vidicon tube. The versatility of this equipment has enabled it to be used in such diverse locations as the Flying Test Bed for the Concord 'Olympus' engine and the studios of one of the most sophisticated broadcasting organizations. Typical environments include the steel industry, power stations, the motor industry, shipping, aviation, advertising and banks.

Marconi's 3-Plumbicon* colour cameras and large screen projectors are being used in the visual flight attachments for the latest flight simulators for such aircraft as the Boeing 707 and the Concord. Marconi closed-circuit colour television equipment has also been used extensively for medical teaching purposes.

One of the first closed-circuit television projects handled by the Company was the preparation of an underwater camera channel to assist in the search for the submarine 'AFFRAY', lost 50 fathoms below the English Channel in 1951. The success of this search led to the adoption of underwater television as an important branch of closed-circuit television technology.

* Registered Trade Mark of Philips' Gloeilampenfabrieken

MARCONI COMMUNICATIONS

Marconi's activities in communications are handled by three Divisions - Radio, Line and Space.

Radio Communications

The Marconi Company is by far the largest British manufacturer and exporter of capital radio communications equipment, and has supplied systems and equipment to practically every country in the world. It is estimated that Marconi manufactures about one-third of all civil radio communications equipment for fixed services made in the United Kingdom, and accounts for forty per cent of the country's exports in this category, a figure which represents about one-third of the Company's total radio communications production.

As with other sections of the Company, Radio Communications Division offers very complete survey, planning, installation and maintenance services for both large and small systems anywhere in the world. Examples of this complete service are numerous, but the Nigerian v.h.f. telecommunications system is probably one of the most impressive. Covering over 2,000 route miles, with an average capacity of 36 channels over this distance, the entire scheme was surveyed and implemented by Marconi engineers, using radio equipment designed and manufactured by Marconi, together with carrier and a wide range of ancillary equipment manufactured by numerous British sub-contractors. A training school was set up in Lagos and run by Marconi to train Nigerian engineers and technicians, to enable them to staff and run the stations on their own.

The range of equipment supplied by the Company covers all the requirements of both civil and military uses for fixed point-to-point services. Systems range from low frequency to microwave and include both tropospheric and ionospheric scatter.

One of Marconi's most important radio communications developments is the range of self tuning h.f. equipment known as MST (Marconi Self-Tuning), for which the Company has received orders worth over £8m, - £6m being for export sales. This system was designed to simplify installation

and operation of all types of h.f. communications station, both large and small, enabling one man to control all the functions of such a centre, including changes in frequency and the running-up of transmitters. System frequency changes can be effected in under a minute without loss of telegraph traffic. Furthermore, a system of remote control permits unattended operation of the transmitting and receiving stations.

Each MST transmitter uses a wideband distributed amplifier (first developed by Marconi for a maritime transmitter which requires no tuning) to provide the drive for the higher power final stage, which is self-tuned by a frequency-following servo system. A 1 MHz master frequency source is used to provide the basic accuracy of the system, and the required frequency for each transmitter is then built up by a synthesizer unit. The synthesizer itself is fully transistorized as are all other suitable parts of the system and a considerable number of separate units can be built into a single control assembly. Decade dial controls on the synthesizer simplify the setting-up of new frequencies enabling tuning to be effected in under a minute, with no other adjustments.

A full range of self-tuning receivers was also developed for the MST system. These receivers are tuned to the desired frequency, within an average of 10-15 seconds, by setting the decade dials on a frequency synthesizer similar to those used on the MST transmitters. The tuning is carried out by solid state, electrically ganged, varactor diodes which eliminate bulky mechanical variable capacitors.

Apart from its obvious operational advantages, MST has many economic advantages, which include considerable reductions in the size of all components of any system, thus simplifying the type of buildings required, and compatibility with existing types of equipment, making it an easy matter to modernize established stations. MST techniques anticipate every foreseeable need in long distance radio communications for at least a generation ahead.

Another important Marconi departure is the 'thin-line' tropospheric scatter system. Until the advent of 'thin-line' tropo, only h.f. or broadband tropo scatter systems were available to carry a small number of telephone or telegraph channels over distances of about 100 to 200 miles in circumstances which precluded the use of land lines or radio relay systems. But short h.f. circuits have known propagation limitations, while broadband tropo scatter systems, having a channel capacity in excess of the small user's requirement, are uneconomic. 'Thin-line' tropospheric

scatter is ingenious and economical and will undoubtedly dominate a section of the short-skip, limited channel market.

Line Communications

In the evolution and application of digital techniques for transmission and data handling purposes, Marconi has played a pioneering role, and is ever seeking to extend the range of its equipments and systems.

Marconidata is a transmission system which provides a rapid means of feeding computers with data to be processed and disseminating the processed data to required destinations. Current Marconidata links are suitable for on- and off-line operation at speeds of up to 800 characters per second.

Terminal equipment developed by the Company includes the well known Autoplex time division multiplex system which incorporates automatic error detection and correction and which leads the world in this field. A unique error-correcting system known as Autospec has been developed for low-capacity systems.

Marconi is currently engaged in the development of a computer-directed automatic message switching/distribution system, using the latest techniques of digital communication and new principles of design.

The Company is also at an advanced stage in the application of pulse code modulation techniques. A 24-channel system has been completed and will be followed by PCM encoding of whole Frequency Division Multiplex groups and TV signals. Additional investigations involve planning multimega-bit line transmission systems for use with apparatus which will combine digital multiplex and data streams.

The commonest devices used as transducers from human language to electrical signals and back again are the telephone and teleprinter. The use of the latter is increasing rapidly and there are demands not only for low-speed machines, but also for higher speed machines and machines with extended repertoires of characters for special purposes, such as communication with computers. The Marconi Company is engaged on a programme of development of teleprinters of this type, embodying completely new principles.

Space Communications

In space communications, Marconi is the first British company to have designed, built and installed complete, operational satellite communication earth terminal stations.

Three such stations - the U.K's first military satellite communication ground system - were ordered from Marconi by the Ministry of Aviation and are playing their part in a joint Anglo-American military project, using near-synchronous communication satellites in equatorial orbit, 18,300 nautical miles above the earth.

The U.K's first overseas civil station was designed, built and installed by Marconi for Cable and Wireless Limited in less than a year. Destined primarily for use in the American Apollo moonshot project, this earth station on Ascension Island is the heart of a key communications system providing split-second information to the Goddard Space Flight Centre via a synchronous satellite above West Africa. The equipment is fully duplicated and any standby unit can be switched in within a fifth of a second. The station was the first in the network to achieve a solid lock on the satellite, which, though planned for synchronous orbit, was then in a highly elliptical transfer orbit. It was also the first to achieve clear speech in both directions with the earth station at Andover, Maine.

Based on present experience, a new range of aeri-als, transmitters, communication and tracking receivers, and aerial control equipment is being designed to meet the INTELSAT global communication system requirements. A key design feature of the electronic equipment is the adoption of a modular approach to permit great system flexibility for differing customer requirements, and to allow for future expansion at minimum cost. Marconi also has its sights set on the future application of satellites to radio and television broadcasting, air traffic control, navigation, meteorology, exploration, reconnaissance and high-speed data transmission.

MARCONI COMPUTERS AND AUTOMATION

Marconi Computers

The considerable expertise which Marconi acquired in data handling and transmission techniques during advanced research and development work in military radar and air traffic control, resulted in the production of the world's first commercially available microelectronic computer - MYRIAD.

MYRIAD, a very high-speed, on-line machine, employs some of the most advanced, high quality microelectronic circuits in the world.

It is housed in a cabinet measuring 6 ft. by 3 ft. by 2 ft. 9 inches high, the size of a typical office desk. It can be finished in teak, plastic or metal depending upon its environment. The machine has a basic storage unit of 4,096 words but this capacity is variable up to 32,768 words. All the controls and indicator lights are mounted in a low superstructure on the desk top, providing full facilities for machine operation and program checking. The superstructure also contains additional controls and indicators for engineers' use. An input/output highway system allows up to 4,000 peripheral devices to be connected to the computer.

An extension to the MYRIAD range of computers has been developed to meet specific on-line requirements.

English Electric Computers Ltd.

Early in 1965 The Marconi Company merged part of its computer interests with the former English Electric-Leo Computers Ltd.

At the same time English Electric purchased the outstanding shareholding of J. Lyons and Company, thus making the new company, English Electric-Leo-Marconi Computers Limited, an associated company within the group. English Electric Computer's, as it is now known, is responsible for the design, development and manufacture of a wide range of modern, high-speed computers for commercial and scientific applications.

System 4, the latest range, is made up of four main processors of increasing power, designed to cover the complete range of computer requirements from those of small businesses to those of Governments or military authorities. The Marconi Company is responsible for the development of the two smaller machines in this range.

All the processors in the System 4 range use microelectronic circuits throughout. The micro-components of the 430 machines have been designed and produced by the Microelectronics Division of The Marconi Company.

Marconi Automation

Because Marconi is active in many spheres, it is familiar with the long-term and day-to-day problems which face the policy-makers and operators in aviation, in telecommunications, in broadcasting, in national defence, in industry and in commerce. It is therefore in a unique position to assess where and how automation can further efficiency. This knowledge, coupled with the vision and imagination which lies behind the Company's software capability, and some of the finest hardware in the world, places Marconi at the forefront of this major growth area.

The MYRIAD range lies at the heart of Marconi's automation systems. It is the basis of the Automated Meteorological System ordered for Sweden; it is the basis of the Swedish Defence System; of the Flight Plan Processing System for the London Air Traffic Control Centre; of the Glasgow Area Road Traffic Control experiment; it plays an important part in the tracking systems of Britain's three military satellite communications earth terminals; it is part of Marconi's Design Automation System.

Automation systems which are under development include an Automated Message Switching System by means of which the collection, storage, processing and retransmission of telegraph messages will be effected by computer. Computer Graphics is another development. This new technology will bring automation to the high-level activities of 'white collar' professionals in industry and commerce. It will revolutionize these activities in the same way as the application of automation has revolutionized so many industrial production processes.

MARCONI MARITIME COMMUNICATIONS AND NAVIGATION AIDS

Since the formation of The Marconi Company, maritime radio has played an important part in the Company's activities. Sales to navies and government authorities throughout the world are the responsibility of the Radio Communications Division, which possesses comprehensive system planning and installation services.

The Marconi Company has designed for naval use a series of units which provide the world's most advanced type of single sideband m.f. and h.f. communications equipment. Widely acclaimed since its introduction, it uses a broadband amplifier based on the 'distributed amplifier' principle. Absolutely no tuning is necessary when the frequency is changed, and the system is consequently simpler to operate and, having no moving parts, more reliable than a conventional amplifier. Associated with this amplifier is a frequency synthesizer, with an extremely accurate frequency standard. These units provide a transmitter driving signal which is sufficiently accurate for the carrier to be suppressed entirely, taking full advantage of the single sideband system. The frequency is set up on the synthesizer unit decade switches, simplifying operation still further.

For merchant marine applications, sales of equipment designed and produced by The Marconi Company are handled by its associate, The Marconi International Marine Company. Liaison is established through The Marconi Company's Mercantile Marine Division.

The Marconi International Marine Communication Company, as it was then called, was formed in 1900 to handle wireless business in the Merchant Navy. This included the provision of fully trained ships' radio officers and a world-wide spares and maintenance service. Today it is easily the largest British exporter of marine radio equipment and is backed by service facilities in every major port in the world. Like The Marconi Company, it offers extensive system planning and installation services. In addition it provides telegraphic accounting facilities for shipping companies.

The very full communications range with which The Marconi International Marine Company is supplied by The Marconi Company includes m.f., h.f., and v.h.f. communications equipment, together with lifeboat radio, automatic

alarm receivers and alarm signal generators. The navigation aids include automatic direction finders, depth sounders and fish locators.

Marconi marine radar equipments are used in both civil and military ships. An important item in the range is a 'stabilized screen' display, which is the only radar display in the world to provide a true motion display with instant selection of a compass-stabilized 'ships-head-up' or 'North-up' presentation. It provides a picture of the situation which exists outside the wheelhouse window, and in exactly the same orientation, thus simplifying the interpretation of the radar information - an invaluable asset in an emergency. In addition, the display can also provide a presentation suitable for comparison with a chart. In both instances, the targets on the screen have an indication of their true motion, without variations and possible smearing due to the movement of the ship carrying the radar.

In addition to the marine equipment range, and also something which is used in naval and Mercantile Marine vessels, is Marconi closed-circuit television. It has been used in widely differing applications, ranging from a Pilot Landing Aid system used in the majority of the U.S. Navy Aircraft carriers to comprehensive entertainment systems in luxury liners and docking aids in large cargo ships.

MARCONI MICROELECTRONICS

Marconi is in the van of the latest technological revolution - integrated electronics. For many years the Company's Semi-conductor Physics Group examined the possibilities of microminiaturization vis-à-vis future generations of Marconi products. In 1964, those years of study and application culminated in the formation of the Microelectronics Division, whose purpose is to provide a service not only to other Product Divisions of The Marconi Company and English Electric but also to European industries and governments. Complete responsibility for the research, development, design, manufacture and sale of microcircuits and microelectronic components and devices is vested in the Division.

Growth in the last two years has been rapid, and from 1965 to 1966 the Division's turnover has increased fourfold. This rate of expansion is expected to continue, for the microelectronics business is the fastest growing area in semiconductor technology. Clearly, within the framework of an organization such as Marconi, it is essential that there should be a powerful facility to design and produce the complex sub-systems now emerging. The £3m Microelectronics Centre, which is nearing completion at Witham, and which will replace the existing comprehensive facilities, will be one of the most advanced in Europe.

The Division's products, which include a wide range of high frequency transistors and varactor diodes, are E.I.D. approved, and a Quality Assurance Organization ensures the continuance of the requisite standards. In addition to being a significant supplier of hardware, the Division offers a technical liaison service to its customers through the Applications Engineering Group.

There is, of course, a continuous programme of development in the Division, which is currently investigating such fields as complex logic arrays using metal oxide silicon field effect transistor technology, and the compatible thin-line techniques in which passive components are deposited as films over the protective layer, beneath which is formed the remainder of the integrated circuits. Development is also being carried out on the translation of circuit functions, as defined in normal circuit terms, into the microminiature masks which will be used to form the component parts of

complex integrated circuits through the various diffusion and oxidation processes which are the basis of the Division's manufacturing techniques.

Other development activities range from the extensive characterization of the various device structures and completed circuits, to the design of special jigs and equipment for the automatic testing of the large quantities of integrated circuits in production. Indeed the design of specialized plant and equipment is an important function within the Division, which has recently expanded its trading activities by granting a licence to South London Electrical Equipments Ltd. for the manufacture and sale of these products.

Marconi Microelectronics is now associated with Elliott Automation Microelectronics.

MARCONI SPECIALIZED COMPONENTS

The Marconi Company has always been a major manufacturer of highly specialized components, because very many of the components necessary for the Company's equipment have proved to be unobtainable in some respect. In this way, a large range of electronic devices has been built up, suitable for application in the field of advanced electronic equipment.

In 1962, Specialized Components Division was set up in the Company to exploit this range of components in world markets. Since those days the Division has broadened its activities. It has become more than a marketing organization for components developed specifically to meet Marconi requirements; it now also develops and produces specialized devices to fulfil the known needs of others within the industry. It is backed by all the resources of the Baddow Research Laboratories and by the many development groups throughout the Company. It can now offer a comprehensive range of the most sophisticated electronic components in the country, covering advanced ferrite devices, which include a diverse selection of waveguide components such as circulators, isolators and high power loads; a very wide selection of quartz crystal products, including highly stable oscillators and frequency standards; high-stability change-of-state crystal ovens - a field in which Marconi is world leader - and a large selection of miscellaneous devices.

DIVISIONAL ORGANIZATION OF THE MARCONI COMPANY

The Company is divided into three major groups which are made up from twelve Product Divisions covering the whole field of modern electronics.

Marconi Telecommunications

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|-------------------------------|---|
| Broadcasting Division | - Sound and television broadcasting equipment. |
| Radio Communications Division | - Point-to-Point radio telecommunications equipment. |
| Line Communications Division | - Telegraph and line telecommunications and message switching equipment. |
| Space Communications Division | - All aspects of satellite ground communications equipment. |
| Mercantile Marine Division | - All aspects of radio and navigation equipment for mercantile marine applications, chiefly for sale to The Marconi International Marine Company. |

Marconi Electronics

- | | |
|-----------------------|--|
| Radar Division | - Ground radar equipment. |
| Aeronautical Division | - Airborne communication and navigation equipment. |
| Automation Division | - Supply of road and rail traffic control systems and computer graphics; supply of industrial automation systems and equipments to other English Electric companies. |
| Computer Division | - The manufacture and production of special purpose computers primarily for Marconi Product Divisions and for the English Electric Group. |

Electro-Optical Systems Division	- Closed-circuit television equipment for all military, educational and industrial applications. Development of MARTEL guided missile television system.
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Marconi Components

Microelectronics Division	- The development and manufacture of advanced microelectronic circuits and devices.
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Specialized Components Division	- A large range of high quality, advanced specialized components for all applications in the electronics industry.
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Two additional Divisions, each entirely autonomous, make up the complete Divisional structure of The Marconi Company. These are:-

Research Division	- This Division is responsible for coordinating all the Company's research and development work.
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Central Division	- This Division controls a comprehensive spares organization throughout the world, covering all equipment manufactured by the Company.
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The Company is mainly situated in and around Chelmsford, Essex, although there are a number of establishments located throughout the country.

Chelmsford, New Street	- Head office and Main works, Headquarters of Broadcasting, Radar, Mercantile Marine, Radio Communications Divisions.
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Chelmsford, Kensal House, Springfield Road	- Computer Division. Standardization Division.
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Chelmsford, St. Mary's House, Victoria Road	- Publicity Department. Organization and Methods Department. R and D Workshops Headquarters.
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Chelmsford, Waterhouse Lane	- Television Development Laboratories. Central Division.
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Chelmsford, Arbour Lane	- Marconi College.
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Writtle, Nr. Chelmsford	- Line Communications Division, Line and Radio Communications Development Laboratories.
Great Baddow, Nr. Chelmsford	- Marconi Research Laboratories.
Great Baddow, Marrable House	- Automation and Space Communica- tions Divisions.
Church Green, Broomfield, Nr. Chelmsford	- Radar Installation Department.
Rivenhall Airfield, Essex	- Production facilities and Radar Testing Ground.
Witham, Essex	- Microelectronics Division.
Billericay, Essex	- Specialized Components Division.
Basildon, Essex	- Aeronautical and Closed-circuit Television Divisions.
Hackbridge, Surrey	- Crystal Design, Development and Production Unit.
Gateshead Works, Newcastle	- Mechanical Engineering and Fabrication
Wembley, London	- Production facilities.

ASSOCIATED COMPANIES AND AGENCIES

United Kingdom

- | | |
|--|---|
| Marconi Instruments,
St. Albans | - A subsidiary company which manufactures a comprehensive range of electronic instruments. |
| Marconi International
Marine Company,
Chelmsford | - An associated company dealing with equipment for mercantile marine applications. |
| English Electric
Computers,
London | - An associated company within English Electric responsible for the design, development and manufacture of a wide range of modern, high-speed computers for business and scientific applications. |
| Eddystone Radio,
Birmingham | - A subsidiary company which specializes in the production of very high quality receivers for all applications in radio communications. |

In addition to the organization in Great Britain the Company has many associated and subsidiary companies throughout the world, and agencies in practically every country.

Associated Companies Overseas

English Electric Marconi Argentina S.R.L., Buenos Aires
Amalgamated Wireless (Australasia) Ltd., Sydney
Amalgamated Wireless (Australasia) New Zealand Ltd.,
Wellington
Companhia Marconi Brasileira, Rio de Janeiro
The Canadian Marconi Company, Montreal
Norsk Marconikompani A/S, Oslo
Marconi Espanola S.A., Madrid
SAIT Electronics, Belgium

Svenska Radioaktiebolaget, Stockholm

Subsidiary Companies Overseas

Marconi (China) Ltd., Hong Kong

Marconi Italiana S.p.A., Genoa, with offices in Rome,
Milan and L'Aquila

Marconi Philippines Inc., Manilla

Marconi (South Africa), Germiston

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Additional information, and photographs to illustrate any point are always available from:

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Marconi House, Chelmsford.

Telephone: Chelmsford 53221 (during office hours)

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