

**MARCONI**  
**AVIONICS**

The teams of professionals at Marconi Avionics maintain a world lead in the design, development and production of avionics systems. Success in the past has been based upon the generation of ideas and this need to generate new ideas creates the challenging and demanding environment that could lead to your success in the future.

## A few facts about avionics

Avionic systems are the electronic control, communications and computing systems that enable the pilot to make the most effective use of his aircraft. In fact, they are often the only means of making a particular manoeuvre or tactical role possible. Such systems provide the means for flight control, navigation, communications, cockpit information displays and numerous other piloting aids. In military aircraft, they also provide tactical navigation and weapon aiming systems. Because of the spectacular increase in the sophistication of aircraft today, avionics has risen sharply in importance and now forms one third of the cost of an aeroplane with engines and airframe forming equal parts of the other two thirds.

## Company background

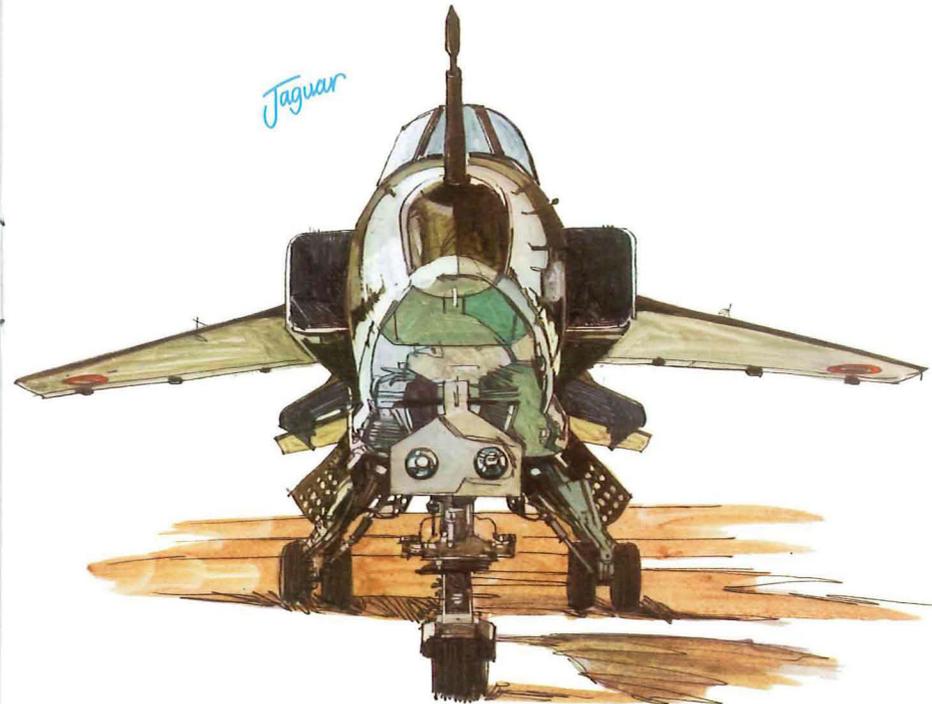
The history of the Company goes back as early as 1910 when a panel of instruments manufactured by the original Elliott Brothers Limited was offered as an optional extra by Short Brothers, who had established the first aircraft factory in the world. Between the two World Wars, Elliott Brothers Limited continued to manufacture electrical measuring instruments and, as a result, were overwhelmed with orders during the Second World War. During the last twenty-five years, the Company has taken shape, become established and emerged as a major force in the field of aircraft automatic controls and electronic equipment. The present name, Marconi Avionics Limited, was introduced after the Company became a member of GEC-Marconi Electronics Limited. Continued research and development has resulted in an impressive list of "firsts" right across the whole range of avionics, together with the Queen's Award for technical innovation, and for export achievement on six different occasions. We now have the largest avionics product range of any company in the world, with equipment installed in over 130 current types of aircraft.

*The Vickers "Gunbus" of World War I and the VC10; two aircraft representing over 50 years' history of our flight instrumentation and control systems*



## Broadening your outlook

Since avionics today forms such a large part of an aircraft's value – and is likely to be even more significant in the future – engineers involved in Marconi Avionics will find career involvement in a number of areas using the most technically advanced electronics and computing techniques. This is enhanced by the opportunity of working on a wide variety of projects for different organisations all over the world. They include Government departments, aircraft manufacturers, airlines, armed forces and overseas companies, with whom we work in close collaboration. This presents many ways of broadening your experience, and by becoming involved in the development of aircraft themselves, with their manufacturers and potential users, you may soon have the responsibility of looking after our customer's interests, wherever he may be in the world.



# The way we work

Because avionic systems are fundamental to the ultimately successful and economic operation of the aircraft, we obviously work closely with aircraft constructors, engine manufacturers, air forces and airlines. This provides ample opportunities for you to work with colleagues from other disciplines and to derive satisfaction from the origination and development of new ideas. The many different types of equipment made and the large number of aircraft involved make it important to provide the means of quick response and attention to a customer's specialised needs. Rather than using a large centralised organisation we operate in a number of Divisions, each dedicated to a particular range of equipment. Within each Division we work in project teams, and each team has engineers at all levels of experience, from graduates looking to consolidate their theoretical knowledge to engineering managers totally responsible for their particular project. As it is Company policy to emphasise promotion from within, we try to ensure that your efforts and ability are well rewarded and, with the sophisticated projects we're currently working on, advancement opportunities for men and women are frequently arising throughout our many project teams.

Electronics engineers, applied mathematicians, applied physicists, computer scientists and programmers, although not necessarily previously experienced in avionics, have tremendous scope when working with us to use their technical knowledge to the full. They are encouraged to initiate, develop and exploit new techniques in electronic and computing technology with the back-up of our own research laboratories and those of the extensive GEC group. Systems engineers utilise powerful computing facilities for simulation and evaluation. Development engineers and circuit designers translate complex digital and analogue circuits into hardware that can confidently be certified for use in the demanding environment of civil and military aircraft. Some programmers advance the arts of real-time, on-line computing for our task oriented processors, using the most advanced computing and data handling techniques known. Others are concerned with executive and operating system techniques. There are also particularly interesting opportunities in the fields of quality assurance, commissioning, test programming for computer controlled ATE, technical authorship and many other areas, all of which can be of special interest to ex-service technicians.



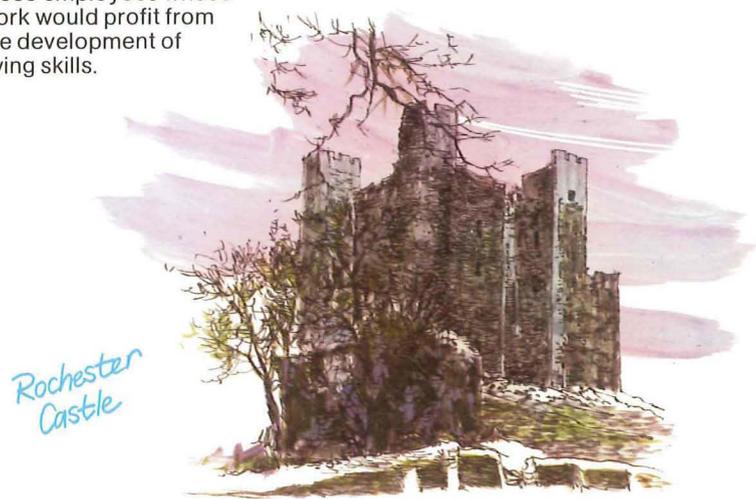
## Making a move



Making a move in your career doesn't just involve changing jobs. Houses, schools, recreation are all equally important – and naturally, the area to which you will be moving.

Rochester is just 40 minutes from London and offers a variety of reasonably-priced housing, education and recreational facilities at every level. Kent has many places of historical interest and the countryside has many attractions. The coastline, which is easily accessible, has many beaches, harbours and sailing facilities.

As far as sporting activities are concerned, the Company has an active social club with each Division also organising its own functions. A subsidised Flying Training Scheme is operated by the Company for those employees whose work would profit from the development of flying skills.



## Our current activities include

### **INSTRUMENTATION**

Air Data Computers  
Low Airspeed Sensors  
Fuel Quantity Gauging  
Fuel Mass Flowmeters  
Gyros  
Accelerometers

### **FLIGHT CONTROL**

Stability Augmentation  
Autopilots  
Flight Directors  
Autothrottles  
Automatic Landing  
Fly-by-Wire Systems  
Quadruplex Actuators

### **POWERPLANT CONTROL**

Digital Engine Control  
Fuel Management  
Range/Endurance Computing  
Engine Intake Control  
Nozzle Control

### **WEAPON SYSTEMS**

Digital Head-up Display  
Weapon Aiming Systems  
Digital Inertial Navigation  
and Attack Systems  
Stores Management

### **NAVIGATION**

Air Data Systems  
Inertial Systems  
Radio Map  
Naval Compass Stabiliser

### **DISPLAYS**

Electronic Head-up Displays  
Electronic Head-down  
Displays  
Multi-Mode and TV Tabular  
Situation Displays  
Projected Map Displays  
Digital Scan Converters

### **MARITIME AIRCRAFT SYSTEMS**

Acoustic Data Processing  
Tactical Navigation

### **AUTOMATIC TESTING**

Computer-controlled  
Testing Equipment

If you would like further information regarding career opportunities please contact –

**The Personnel Manager,  
Marconi Avionics Limited,  
Airport Works, Rochester, Kent ME1 2XX.  
Telephone: Medway (0634) 44400 extension 465.**



1978

# Airborne Display Division

We're the world's most experienced manufacturer of Head-Up Display Systems, having supplied over 2400 systems more than double those produced by all other manufacturers. Almost all of these HUD's, as they are called, are exported and equip aircraft such as the LTV A-7D/E, McDonnell Douglas A-4 and the General Dynamics F-16 and many of the present-generation systems include sophisticated weapon aiming computations, known as Head-Up Display Weapon Aiming Computers or HUD/WACs.

In addition to HUDs and HUD/WACs, the Division manufactures a range of dedicated computers for use in both air and land vehicles, together with all associated test equipment. We also design and produce a variety of advanced electronic displays for direct viewing – designated Head-Down Displays. These displays are fitted to aircraft such as the Multi-Role Combat Aircraft (MRCA) and the refitted Nimrod, where they form part of the new Sonics system the Company is developing.

Because of the very high percentage of export business, overseas facilities have been established to manufacture locally where necessary. One

such facility exists in Atlanta, Georgia, USA, where A-7D/E and A-4M equipment is manufactured. Other manufacturing organisations are being set up in the European countries where the F-16 aircraft has been sold.

The Division has a work force of about 450 people, distributed amongst the Engineering, Production, Commercial and Sales Departments. Of these, the Engineering Department employs about 200 people.

All work is carried out on a project basis, i.e. during the design and development phase, a group of engineers work as a team on a particular system. This enables an engineer to identify with that equipment, and provides a variety of interest as the project moves through development. A project team is normally headed by a Project Manager, responsible for all aspects of his program and is assisted by a staff of Project Leaders, Project and Development Engineers and Technical Assistants. Each Project Manager is himself responsible to the Chief Engineer.

In general, engineers are qualified to HNC, HND or Degree standard and employment opportunities

existing within the Engineering Department reflect the wide spectrum of skills and techniques used in the equipment manufactured by the Division. Much of this equipment is based on specialised digital computers whose outputs are used, via the appropriate analogue circuitry, to drive and cathode ray tube displays. Consequently, advanced digital and analogue design forms a major activity within the Department. These designs are evolved using the latest "state of the art" devices and techniques such as microprocessors and Schottky logic. The associated analogue

circuitry also covers a variety of disciplines varying from relatively low frequency deflection amplifiers through to high bandwidth video amplifiers compatible with UHF television systems.

A Systems Group exists within the Department, not attached to any one project, consisting of various specialists who act as consultants for the different projects. The activities covered by this group include Computer Programming, Optical, Mechanical and Thermal Design, in addition to more theoretical systems investigations.

# Automatic Test Equipment

Like all the other divisions within the Company, this is a completely autonomous unit responsible for all sales, design and development and production activities associated with sophisticated avionic test equipment. The division's products range from tape controlled semi-automatic test equipment to the very latest computer-controlled, third generation ATE. In this third generation equipment, the computer is the heart of the system controlling a Stimulus and Measurement Unit. This has been designed and developed by engineers within the division and the ATE is the only type of its kind to be made anywhere in Europe, marking a significant advancement in technology. The technique employs a sampling system whereby waveforms are sampled by a sampling head with an associated Analogue to Digital Converter. The samples

are stored for the computer to carry out mathematical analysis at a later stage. In the Stimulus Unit, the output is from a Digital to Analogue Converter and here the waveform is built up in the computer store and output to the DAC as a series of computer words.

Currently, the division is employed on work for the design and development of specialised ATE for the Multi-Role Combat Aircraft. Work is taking place on providing both factory test equipment for the AQS 901 Sonabuoy data processing equipment, which is being fitted to the Nimrod Mk II, and for the 2nd line ATE for this, and the other Nimrod Mk II Avionics, for the Royal Air Force. Special support equipment has been supplied to the United States Navy and Air Force and this contract is still supplying sets of

equipment which are supported by ATE Division's representatives in the USA. Further work is being negotiated in various countries within Europe, the USA and Japan.

The engineering section is responsible for the production of the Test Programs for the ATE, the writing of system software, to drive the ATE instrumentation and peripheral devices such as magnetic tape handlers, discs, cassette, line printers, paper tape readers; the design of interfacing circuitry for specialist instruments; the design of specialist instrumentation, and the overall design of total systems of ATE to cover the whole avionics fit of a particular aircraft.

There are opportunities in this division for Electrical/Electronic Engineers, Applied Physicists, Computing Engineers and occasionally Mechanical/Production Engineers. Because of the

nature of the work, experience on up-to-date equipment in the radar/communications field would be particularly useful.

Within the division a balance is sought between young engineers qualified to degree standard, and more senior experienced personnel. It is found that senior technical grades within HM Forces provide the balance and experience particularly suitable for test program engineers, whereas the design staff would preferably be graduates.

The divisional engineering structure to Chief Engineer has two main streams, one path of promotion being through the project to Project Manager, the other being via the design and development group to Assistant Chief Engineer, thence to Chief Engineer.

The Engineering Department of ATE employs approximately 150 qualified engineering personnel.

# Combat Aircraft Controls Division

The main products of Combat Aircraft Controls Division are automatic flight control systems (AFCS) supplied for fixed-wing combat aircraft. The Division is involved in the complete process of system and equipment design, development, manufacture, rig and flight test and the production of equipment for in-service use. A significant part of the current business is in Europe.

The systems range from simple autostabilisers to complete digital AFCS and involve gyros, accelerometers and actuation systems as well as the Division's own designs of analogue and digital airborne computers.

This Division currently employs over 460 people and over 160 of these are in the Engineering Department which employs over 90 qualified engineers. The main current projects in the Engineering Department are: -

## Harrier and Sea Harrier

Both aircraft types are fitted with a three-axis stability augmentation system which operates during take off, transition, normal flight and

hover. Additionally, the Sea Harrier is equipped with an autopilot which provides height, attitude and heading hold facilities.

## MRCA (Tornado)

Fly-by-wire command and stability augmentation system, digital autopilot and flight director, quadruplex electro-hydraulic actuators, spin prevention and incidence limiting. The MRCA (multi-role combat aircraft) is an advanced swing wing supersonic aircraft developed jointly by UK, Germany and Italy and is now going into production.

## Jaguar

A full time digital fly-by-wire system, incorporating command and stability, augmentation and autopilot modes, is being developed to fly in a Jaguar.

This system using four channels of high speed processing with software synchronisation is the forerunner of future combat aircraft fly-by-wire systems.

## New Developments

Advanced digital technology is employed in the systems and support

equipment including microprocessing, large scale integrated circuits and optical data transmission. Extensive use is made of high level languages for software development on disc operating systems.

Each project has its own team of engineers carrying out the design, development and commissioning of equipment, defining all of the specifications and technical documentation and supporting the customer's test rigs and development aircraft.

The theoretical analysis and simulation to design the system and to specify the performance of the system elements is carried out by systems engineers who work

closely with the project team. The software for digital systems is developed by systems engineers working as part of the project team and the applications team works on potential new systems research and development and the application of new technology.

Graduates in electrical and electronic engineering, control, computing sciences, mathematics, physics and engineering sciences are suitably qualified. Technical and management training both within and outside the Company is given to fit in with individual career development and young engineers may be sponsored for pilot training with the Company Flying Club.

# Central Quality Department

The standards of quality and reliability offered by the company are an essential part of the performance of avionic systems and this Department works to help assure customers that "nothing shall fail" in the extreme environment of an aircraft. Quality Assurance is regarded by management as a vital activity requiring specialist support and C.Q.D. fulfils this task by providing services of a specialised nature to the Company's Divisions at Rochester. These services can be split into two categories: – Service Activities and Corporate Services.

## A. Service Activities

(i) Provision of Quality Engineering services to Divisions, notably in the preparation of reliability, maintainability and electro-magnetic compatibility plans, the carrying out of analyses and advising in the specialist fields of type approval, qualification and reliability demonstration testing.

(ii) Provision of an Environmental Assessment Laboratory, where a wide range of mechanical and climatic tests are carried out on equipments.

(iii) Provision of an Electro-magnetic Compatibility Assessment Laboratory where

investigations and tests are carried out on equipments.

(iv) Provision of a Component Test Laboratory, where electrical tests are carried out on components.

(v) Provision of Electrical and Mechanical Calibration Laboratories where sophisticated measuring and test equipment is checked and calibrated against higher grade instruments, with traceability to National Standards.

(vi) Provision of an electrical test equipment repair facility where faulty test equipment may be rectified.

## B. Corporate Services

(i) The generation and maintenance of documentation relating to Quality matters.

(ii) Performance of independent Quality Audits.

(iii) Providing an interface between the Divisions of the Company and appropriate organisations in the interpretation and adoption of general Quality Assurance policy.

These specialist activities are also provided for other companies and for government departments.

Quality Assurance staff are recruited from people already experienced in Q.A.

techniques, from graduates, and from ex-service technicians with appropriate technical experience.

As far as graduates are concerned, much of our work would be particularly interesting to people trained in electrical/electronic engineering or applied physics/electronics disciplines. The environmental assessment laboratory has limited requirements for graduates with a training in mechanical engineering. Graduates are trained "on the job" and are involved in specifying,

performing and reporting environmental tests on a wide range of avionic equipments. The identification and solution of design problems shown up by environmental testing involves close cooperation with equipment design teams.

The function of Central Quality Department, by its very nature, offers suitable graduates a unique opportunity to learn about a variety of electronic equipments in a relatively short time by becoming involved in a range of testing activities aimed at exposing design weaknesses.

# The Flight Automation Research Laboratory

This is an applied research engineering facility where the main function is to investigate and exploit new areas of technology likely to lead to new and improved avionic products and systems for development by the operating divisions.

An avionic control system will include sensors to measure the behaviour of the aircraft and its component elements, some form of signal processing (computing) and actuators to drive the aircraft control surfaces. In addition, since the various units will be physically remote from each other, signal data must be transmitted between them. The sensor data and the results of signal processing need to be displayed to the crew; similarly the crew need a means to instruct the system to carry out specific tasks. Finally all elements of a control system need power, and the provision of suitable power from the main aircraft supply needs specialised circuit techniques.

To meet these requirements which cover a wide range of technical disciplines and product areas, the Laboratory is organised into the following teams whose specific skills embrace the above elements.

## Computing and Control

This team develops much of the theoretical background to our avionics system design, embracing such disciplines as control theory, systems integrity and new computing technology.

The team evaluates advanced computing concepts for avionic applications, which includes designing and building computing systems to verify their concepts.

## Sensors

The Sensors team develops 'solid state' sensors to replace electro-mechanical devices with the aim of reducing maintenance skills and costs while meeting the hostile aircraft environment.

The electrical interfaces between sensors and digital processors receive special attention.

## Displays and Controls

In advanced aircraft there is a need to display large amounts of data in forms appropriate to the crew's needs. Cockpits are overcrowded and modern aircraft incorporate an increasing proportion of multi-mode electronic

displays. Development proceeds on Head Up (projected), direct view and helmet mounted displays exploiting CRT's and solid state displays such as LED's and LCD's.

New methods of data insertion and pilot command include speech recognition techniques to free the pilot's hands.

## Data Transmission

Digital data transmission systems including fibre optics are under active development to meet demands for high system integrity, high bandwidth and high immunity to electro-magnetic interference.

## Design and Manufacture

This team examines the requirements of the Company for advanced methods of design and manufacture and conducts appropriate pilot projects. Current activities include computer aided engineering systems including hybrid and LSI design techniques, thermal design and novel cooling techniques, and methods of connection and assembly.

## Power Supplies

The Power Supplies team investigates new techniques for power conditioning aimed at increased efficiency, high packaging density and high reliability to meet the very arduous demands in avionic equipment.

## Advanced Projects

A team of experienced engineers carries out studies and project management allied to advanced manned and unmanned aircraft and new system techniques for tasks such as navigation.

## Optomechanical Design

This team provides a service in optical system studies, design and ray tracing and produces prototype systems for evaluation.

The Laboratory is particularly interested in recruiting graduates for these various teams, who have the ability to develop new ideas and concepts and can respond to a high degree of technical challenge in a wide range of disciplines.

Graduates (and post graduates) in Electronic/Electrical Engineering, Computer Science and Physics are particularly sought after but there are also limited vacancies for graduates in Mechanical/Production Engineering.

The Laboratory which has a total work force of over 100 maintains a Model Shop which is well equipped with machine tools and possesses comprehensive computer facilities for design analysis and simulation.

A considerable proportion of the Laboratory prototypes delivered are to flightworthy standard.

# Flight Controls Division

The main products of Flight Controls Division are automatic flight control systems (AFCS) supplied for all types of aircraft, except fixed wing combat aircraft which are the responsibility of Combat Aircraft Controls Division.

Divisional programmes include subsonic and supersonic commercial transports, rotary wing aircraft and remotely-piloted aircraft. The Division is involved in the complete process of system and equipment design, development, manufacture, rig and flight test and the production of equipment for in-service use. A significant part of the current business is in Europe and the United States.

The systems range from simple autostabilisers to automatic landing systems and complete digital AFCS and involve gyros, accelerometers and actuation systems as well as the Division's own designs of analogue and digital airborne computers.

This Division currently employs 300 people and over 140 of these are in the Engineering Department which employs over 70 qualified engineers. The main

current projects in the Engineering Department are:—

## Boeing 747

Improved automatic throttle system capable of control from before take off to landing. Works with all 747 engine configurations.

## Boeing YC-14

The fail-operational digital AFCS has operated very successfully in the USAF flight test evaluation.

## A310 Airbus

High integrity digital slats and flaps drive control. This European Airbus transport will enter airline service in 1982.

## Concorde

Fail operational stability augmentation system, autothrottle and autopilot, including automatic landing. This Anglo-French supersonic transport entered airline service in January 1976.

## Lynx

This Westland rigid rotor helicopter, which is now in service, has a fail operational stability augmentation system, the autopilot controls down to the hover at low altitude for rescue and anti-submarine operations.

## Universal Drone Autopilot

A new AFCS for conversion of ex-service aircraft to aerial targets remotely controlled by a radio link.

Initially fitted to the Sea Vixen Naval Fighter, the system controls all aircraft functions during a flight from brakes off to standstill.

## New Commercial Aircraft

A company funded advanced digital flight control system using the latest digital techniques is being developed for new commercial aircraft in Europe and the USA.

## New Developments

Advanced digital technology is employed in the systems and support equipment including microprocessing, large scale integrated circuits and optical data transmission. Extensive use is made of high level languages for software development on disc operating systems.

Each project has its own team of engineers carrying out the design, development and commissioning of equipment, defining all of the specifications and technical documentation and supporting the customer's test rigs and development aircraft. The theoretical analysis and simulation to design the system and to specify the performance of the system elements is carried out by systems engineers who work closely with the project team. The software for digital systems is developed by systems engineers working as part of the project team and the applications team works on potential new systems research and development and the application of new technology.

Graduates in electrical and electronic engineering, control, computing sciences, mathematics, physics and engineering sciences are suitably qualified. Technical and management training both within and outside the Company is given to fit in with individual career development and young engineers may be sponsored for pilot training with the Company Flying Club.

# Gyro Division

The Division is concerned with the manufacture and development of Gyroscopes, Accelerometers, Associated Electronics Equipment and complete Attitude Sensing Units.

Initially involved in research and development work on inertial gyros, it began handling sub-miniature fluid-filled gyros under a sales agreement with Northrop Nortronics of the USA and later commenced the manufacture of precision miniature rate gyros. This aspect of their business has continuously expanded and the Division now makes several different types of rate gyros and accelerometers for aircraft and missile use as well as directional and vertical gyros for underwater weapons together with microprocessor based strapdown gyro guidance and control systems.

Over the years gyro/accelerometer/sensor packages from Gyro Division have been supplied for the following projects:—

TSR2 Sea Vixen, Hawker Harrier, Concorde, Phantom, WG13 (German) and A4M (USA) Aircraft UK Sparrow, Sea Dart, Martel, Sea Cat and RBSTO (Sweden) air missiles, ESRO TD/1 Satellite as well as MK.24 Torpedo and other underwater missiles.

Gyro Division has some of the most advanced precision gyroscope design, development, manufacture

and test facilities in Europe. In addition to the extensive clean areas available to Marconi Avionics a super-clean area was brought into operation in Gyro Division during 1963 for the assembly of sub-miniature and other gyroscopes and for investigation into inertial navigation components including gas lubricated and precision ball bearing spin axis systems.

As a large manufacturer of precision gyroscopes and gyro systems, Gyro Division presents excellent opportunities for people joining our design and production teams. Men or women with academic and/or practical experience in design engineering, computing and personnel with production engineering and precision manufacturing experience are all required to work in any one of the following areas:—

## Engineering

Is concerned with the design development and research of gyros and associated components. The work involves:— the design of new gyros and gyro systems for aircraft/missile applications, preparation of specifications of customer's requirements and engineering liaison during the development and trials phases of projects. The Engineering Department team consists of highly qualified analogue and digital electronics designers,

mechanical engineers and computer engineers.

## Engineers

Are recruited from graduates in engineering, physics and computing or from people with equivalent qualifications or experience.

## Inspection and Test

Covers all aspects of mechanical and electrical inspection, from incoming goods to final despatch, as well as the testing of all sub-assemblies and complete units that are produced by the Production Department. Inspectors and Testers are recruited from people with experience of electro-mechanical equipment manufacture or inspection. An essential aspect of the work is Quality Control and carries the responsibility for maintaining the very highest order of quality and reliability in the equipment delivered to our customers.

Work includes investigations into components suitability and basic engineering in the design phase and into manufacturing techniques during the manufacturing phase.

## Project Leaders

Are responsible for the planning, execution and reporting progress on projects. They are also responsible for recommending action to keep projects to planned costs and timescales.

## Project Managers

Are recruited from people with experience of project planning and management in the electro-mechanical or aircraft industry.

## The Drawing Office

Is a self-contained unit responsible for the preparation of drawings for manufacture. The work involves a very high standard of design and offers interesting and rewarding opportunities for Designers, Draughtsmen and other levels of drawing office staff.

## Clean Area Assembly Technicians

A high calibre of personnel are required for this work. People with previous experience as Instrument Makers/Fitters, Watchmakers and Instrument Technicians prove best suited for the challenging standards needed to produce precision gyros and accelerometers. Training is given to suitable applicants, who will find the clean area working conditions the best that can be obtained.

## Production Engineers

Are responsible for the production methods used and for scheduling the work in the Production Department to ensure that it flows smoothly through the shops on time, and that all necessary materials and components are available.

# Inertial Navigation Division

## The Products

Since its formation 21 years ago Inertial Navigation Division has designed and put into production four I.N. systems, three of which are still in use. Two of these are in full production to meet the requirements of British and foreign naval and airforce customers.

Because of its success 12 years ago in the application of digital technology to complex airborne inertial systems the Division was contracted to undertake responsibility for the design and production of the central Tactical System of the Nimrod MKII maritime patrol aircraft for the Royal Air Force. This system is now flying in production aircraft and is meeting all the complex demands placed on it at a far earlier stage in its life in service than would normally be expected.

In addition work has started on a digital data highway for the new Westland helicopter. This will make use of the latest generation of microprocessor devices and memories, in a very demanding application.

To maintain our reputation for system design ability it is essential that studies are made of next generation needs and ways of realising them. Current studies include strap down inertial navigation, use of novel gyros and optimisation of performance by hybrid systems.

The products, past, present and future, have a number of features in common. They all have to meet stringent operational and environmental conditions in which accuracy and reliability are prime considerations. They all have to be designed within severe weight and space specifications. They all have to be readily maintainable in operational service. The development needed to achieve this combination requires a lot of team work by well qualified people of various specialisations – in a word, sound engineering in a high technology environment.

## The People

### **Systems Engineers**

The work of this section is fundamental to the development of complex systems. The systems engineer

specifies the system, models it, simulates it, and eventually analyses its actual performance. A further responsibility is the hardware/software split the basic structure/design of the realtime programs which are such an important feature of current avionic systems.

### **Development Engineers**

The majority of the Development Engineers in the Division are graduates in electrical/electronic engineering. They are involved in all phases of the development projects such as:

- (a) circuit design and proving
- (b) development system test and commissioning
- (c) flight (or sometimes sea) trials

Graduate mechanical engineers are responsible for the very important environmental aspects of development, including vibration and thermal stress analysis.

### **Computer Programmers**

The work of the Computer Programmer is assuming an increasingly significant place in the development of avionics systems. In I.N. Division it is almost all concerned with the writing and proving of large realtime programs using, in the main, high level language such as CORAL. The interaction between software and

hardware broadens the programmers horizons and program proving activities provide tangible satisfaction of achievement.

## **The Organisation**

The Engineering Department has a semi-matrix structure of which the basic units are project teams and specialist offices. Each team, controlled by a Project Manager is responsible for one development project. The specialist offices, Systems, Circuit Design and Programming, provide the inputs to the project teams appropriate to their own area of activity.

The project teams and specialist offices are organised in sub divisions headed by a Project Leader. The Project Leaders are also responsible for the essential day-to-day liaison with other sections of the Engineering Department such as the Drawing Office and Technical Publications, and with other departments such as Production, Quality Assurance, Contracts and Cost and Budget. More junior engineers are also involved in this as the need arises. Such involvement is considered to be an important part of their career development.

Normally the Project Manager, with help from

appropriate team specialists, handles meetings with the customers. Project Leaders will often be required to lead discussions in their specific responsibility and promising junior engineers form the back-bone of on-site (at customers establishment) teams, providing early career experience in representing the company.

Arrangements are made for engineers to visit sites where their equipment is in use.

A major facility in the Division is a G.E.C.4080 multi-access computer with a wide range of peripherals. This is used primarily by systems engineers and programmers for simulation, modelling and program generation.

### **Development Engineers**

A BSc or HND in Electronics or Applied Physics is the basic qualification for appointment as a Development Engineer. However mature applicants without such formal

qualifications but having substantial experience in the maintenance of complex electronic equipment gained, for example, in the Armed Forces, are also welcome.

### **Computer Programmers**

Applicants in this specialisation normally have a degree or HND in Computer Science, Mathematics or Applied Physics. However hardware specialists have successfully converted to software design 'on the job' and this leads to valuable combination of skills.

## **Qualifications**

### **Systems Engineers**

Appointments as Systems Engineers are seldom made on first graduation. Engineers normally change to systems work after three to five years experience if they wish to do so and are judged to have the aptitude for this type of work. The possession of a second degree such as an M.Sc in Systems Engineering, although not essential, would help in this direction.

# Instruments Systems Division

A wide diversity of products involving most electrical, electronic, mathematical and mechanical technologies summarises the scope of the Division's activity. This broad product range is now expanding into new areas by the application of state-of-the-art semiconductor technology to novel concepts. With a total workforce of about 350 the Division is small enough to generate a high level of management interest. The diversity of work and expanding nature of the business ensures that the new graduate can rapidly identify with the products and derive job satisfaction and career development soon after joining.

The range of products is extremely large due to previous diversification of the Division's business. Current activities can be summarised as follows:—

## **Air Data Systems:**

Analogue and Digital Air Data Computers using pressure sensors to provide multiple electronic outputs of height, airspeed, Mach etc. for other aircraft systems.

## **Fuel Systems**

Instruments and sensors to measure, adjust and display

rate of fuel consumption, fuel used, and fuel quantity.

## **Helicopter Systems:**

A range of novel systems developed entirely within the Division. One type is aimed at overcoming the problems of providing accurate Air Data information on helicopters, where the direction of movement capability of the helicopter makes conventional systems entirely inadequate. Another provides a method of computing the lifting capability of the helicopter under the wide range of conditions and circumstances in which modern helicopters operate.

## **Stores Management Systems:**

Complex multi-unit digital systems providing high integrity release control of the wide range of conventional weapons carried by modern military aircraft. This is a new, and rapidly expanding product line in the Division.

**Others:** A consistent feature of the Division's activities has been the frequency with which new and novel ideas emerge and are accepted by the Company for private venture funding. Several such ideas are at various stages of development in the Division.

There are opportunities for Electronic/Electrical Engineering Graduates, Computer Scientists, Mechanical Engineers. Also Physicists and Mathematicians (with an interest in Electronics and Programming) are required to join the project teams, which are at different stages of the design, development, manufacture, commissioning and flight testing of the product ranges mentioned above. Each project group is a compact, very self motivated team dedicated to its particular tasks.

Instrument Systems Division pays particular attention to encouraging employees to actively seek a line of career development most suited to their personality. Both technical and

management lines of advancement are open to all after an initial period of gaining expertise, and most important in avionics, experience. The current strength of the Engineering Department is around 150. Of this number, approximately half are engineers, programmers and engineering management personnel. The other half consists of Drawing Office, Model Shop, Technical Publications and associated personnel.

In parallel with the development of new high technology systems many new techniques for improved Production Control, manufacture, test and inspection are being introduced for which graduate engineers are also required.

# Maritime Aircraft Systems Division

The division was originally set up as a project team to investigate and develop digital airborne computing systems. In co-operation with other divisions it has designed, developed and produced digital hardware and software for Head-Up Display systems, Inertial Navigation systems and Navigation and Weapon Aiming systems and it is a world leader in airborne real time acoustic processing systems for fixed-wing and rotary anti-submarine aircraft. These systems are currently in production for the Royal Navy, Royal Air Force and overseas forces.

The division also continues to develop its computing technology both in the hardware and software field and is responsible for the design and application of advanced airborne digital computers such as the 920ATC.

The division's activities embrace the total system engineering development, hardware design and manufacture and overall programme management.

The main functions within the engineering teams are as follows . . .

## Systems Design and Integration

This team takes the Customer specification for acoustic processing and associated information flow systems and interprets these into a system design as defined by detailed hardware and software specifications. The team analyses and controls the development activities necessary to meet performance within the prescribed cost and time scales.

The team is also responsible for the overall integration of elements of a system into a working whole and involves the in-house rig commissioning of systems and measurement and analysis of system operational performance, from both in-house and field trials activities.

## Programming

The programming activities cover a broad range of software technologies encompassing real time programming in high level languages, mathematical modelling, assembly language programming and compiler development. An extensive range of in-house computers and support facilities are available for use by the programming teams.

## Hardware Design

This team is responsible for the electrical and mechanical design of computers and other system elements marketed by the division. They take the design from initial concept through the prototype and qualification phases to preparation for series production. Computer aided design facilities coupled with state-of-the-art technology to ensure quality high performance products, are used extensively by this team.

## Engineering Services

These include Drawing Office and a Technical Publications Section, as well as laboratory and library services :

The drawing office is a self-contained unit responsible for the preparation of drawings for manufacture. The latest computer controlled draughting equipment for digitising and interactive design is used for multilayer PC board layout and artwork generation. The work involves

a very high standard of design and offers interesting and rewarding opportunities for Designers, Draughtsmen/ women and all Drawing Office staff.

The Technical Publications Section is concerned with the preparation of technical instruction manuals, reports and other associated documentation. The documents are written to meet the requirements of commercial, British and American Government standards.

## Future Systems

This team is primarily concerned with the response to proposal requests from prospective customers and operates closely with the Design and Sales teams.

The division is growing rapidly and there are excellent opportunities for people to join our design, manufacturing and marketing teams. Due to the international nature of our business many of the positions available offer opportunities for travel overseas.

# Powerplant Systems Division

## The Market

Although the basic concept of the Gas Turbine Engine is extremely simple, the development of modern high performance aircraft has led to a demand for powerplants to meet an ever increasing range of performance criteria including high maximum thrust, rapid response, low fuel consumption, good stability, low noise levels, etc. These demands have been met by detailed research into the design of engines and the evolution of increasingly sophisticated control systems.

In recent years, in order to match the continuing growth in complexity of gas turbines, attention has been directed towards the use of electronic techniques for the instrumentation, monitoring and control of aircraft gas turbine engines. This is the market of Powerplant Systems Division.

## The Division

Because this is a relatively new market, Powerplant Systems Division is a small, compact and, we hope, friendly team. The largest group within this team is the Engineering Department which consists of young scientists, engineers, programmers and draughtsmen. Most of these have qualified, through full time courses at universities or polytechnics, through day release taking National Certificates, or by acquiring relevant experience. The principal disciplines from which they are recruited are electrical, electronic and mechanical engineering, physics, mathematics and computer sciences, but other courses having a significant element of one or more of these disciplines are also of interest. The success of the Division's products depends on a total appreciation of every aspect of the design and engineers are encouraged to take a multi-disciplinary approach and to gain the widest possible experience.

In addition to the engineering team the Division comprises of clerical, administrative, financial, sales, manufacturing and quality assurance staff recruited from people with appropriate disciplines and an interest in engineering.

## Facilities & Resources

In addition to access to a wide range of Company computing facilities, the Division also has computers in-house. The Division is also responsible for the Company Fuel Systems Laboratory which has the capability for testing fuel systems over a wide range of flow rates and temperatures and is one of the most advanced facilities of its kind. In addition, apart from the other technical resources of the Company, the Division can call on the extensive research facilities of GEC and of the Company's own Flight Automation Research Laboratory.

## Programmes & Technology

The Division's activities include advanced electronic fuel control systems, fuel measurement systems and automatic monitoring and test systems for gas turbine engines for customers in the United Kingdom and overseas. The technologies involved include engine performance, mechanical design for harsh environments, failure surviving electronic and electro mechanical systems, fluid flow, high and low level programming and the mathematical aspects of engine performance, control systems stability, fluid flow, thermal design, reliability, maintainability, etc.

The Company has demonstrated its ability to open up world markets in a wide range of avionics. With this background Powerplant Systems is becoming yet another success story. Staff joining now can expect to join the team at an interesting and formative period of its development and to contribute to the development of a major new technological market.

# Aviation Service and Repair Division

This division provides a total support facility for equipment manufactured by the product divisions at Rochester, aimed at satisfying the needs of both Civil and Military customers. Our activities embrace repair and overhaul, defect investigation, warranty administration, initial provisioning, supply of spares, product improvement, design and production of special test equipment, technical publications, training and field service and comprehensive support is provided world-wide.

A special feature of the division is its third-line specialist maintenance exchange and repair scheme currently operated for the Jaguar navigation and weapon aiming sub-system and Lynx helicopter automatic flight controls systems. A similar repair scheme, covering the several systems designed by Marconi Avionics which are used in the Tornado aircraft is now in operation. This requires the supply of fully commissioned special test equipment, the procurement and management of spares inventories, the preparation

and validation of repair documentation and the training of service personnel.

Wide experience is provided in all the Company's products and engineers are required to obtain specialist knowledge by working with development teams in product divisions with a view to transferring their knowledge to the product support organization.

Graduates in Electronic Engineering conversant with analogue and digital techniques are required to be engaged on design of third line special-to-type test equipment and maintenance and trouble-shooting of complex airborne control systems. Additionally, engineers are required for on site support of these systems at Service establishments and civil Airports.

Some of our current and projected tasks include the support of BAC 1-11, VC10, A310, Concorde, Boeing 707 and 747, Tornado, Lynx, Jaguar, Nimrod and F16 Aircraft, together with a Naval compass system.

# Electronic Data Processing

EDP is a site resource serving the product divisions, MA management, and other service departments at Rochester. It is almost entirely concerned with commercial data processing, thus complementing the technical computing facilities available in the avionic divisions.

The EDP service may be divided into two main areas:

1. Monitoring and reporting of transactions and performance, mainly in the financial accounting area, and -
2. Direct assistance, as an information service, with the design, manufacture, and post-delivery support of the Company's avionic products in the various specialist divisions.

In this latter role the EDP support covers the whole product life-cycle from the preparation of proposals and bids, through product design and definition to production planning, scheduling, ordering of materials and components, implementation of the build programme, and finally the support of the equipment when in service, for example by spares provisioning and the analyses of field performance data.

EDP has a staff of more than fifty, working in three main areas:

1. Management and Administration
2. Computer Operations  
The operations department is concerned with the running of EDP's computers and also with providing a data entry service using key-to-disc equipment. The

mainframe equipment currently in use consists of two large ICL2904/50 installations and a CMC Sovereign 8500. These three machines support some fifty terminals in the user areas at Rochester and are themselves connected to the massive IBM resources at the GEC computer centres at Chelmsford and Stafford.

3. Systems and Programming  
This is the largest department in EDP and is responsible for the conception design and implementation of systems in response to customer requirements, and for support and user training when the system is in service. The department is organised in project teams of systems analysts and programmers each with a project leader or manager, in a way similar to that of an engineering department in an avionic division.

A prime requirement for systems and programming staff is the ability to understand the user's commercial requirements and their relationship to the total Company operation, and to be able to relate these to effective technical solutions.

To do this successfully, it is necessary to combine a genuine interest in commercial techniques with a numerate, logical approach to problems and a sound knowledge of computing technology.