AVIONICS NEWS

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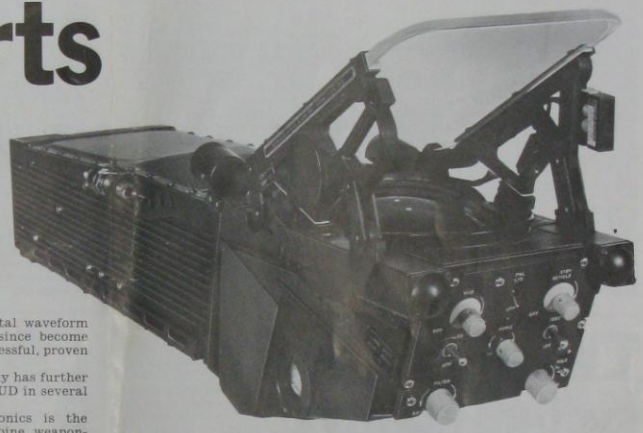
HUD exports top 1000

Head-up display Pilots Display Unit and electronics unit supplied for A7 Corsair



***World's leading HUD manufacturer introduces important new capabilities**

THE FIRST manufacturer to market a fully operational head-up display, Marconi-Elliott Avionics, has now delivered well over 1500 such systems of which over 1000 have been exported.

Five aircraft types are now in squadron service with head-up displays. Of these, four have been equipped by Marconi-Elliott Avionics. The four are the Vought Systems Division A-7, McDonnell Douglas A-4, SAAB Viggen and Hawker Siddeley Buccaneer.

Marconi-Elliott Avionics made a major technological step forward in 1966 when it introduced the first HUD system with digital waveform generation which has since become well established as successful, proven equipment.

Recently the company has further developed the digital HUD in several important new ways.

Marconi-Elliott Avionics is the first company to combine weapon-aiming calculations in the HUD's own digital computer to achieve efficient, advanced self-contained HUD Weapon Aiming Systems (HUDWAS). These systems can provide a comprehensive range of sophisticated air-to-air and air-to-ground weapon delivery modes.

The latest development of far-reaching significance is TRAM (Target Recognition Attack Multisensor). By electronically combining the display of a low light level or infra-red sensor in the HUD system with the HUD symbols, the pilot can be given night vision. This arrangement, giving the pilot 24-hour capability, offers significant ergonomic advantages and simplifies cockpit layout. A radar display can also be incorporated. □

Doppler on Sea Kings

Export to six countries

Royal Navy Sea King on operational patrol

WESTLAND AIRCRAFT LTD have received more export orders for the Sea King anti-submarine helicopter, bringing their total order book to well over 100. All these aircraft will be equipped with the Marconi-Elliott Avionics AD580 Doppler Navigation System designed specifically for helicopter and other VTOL aircraft. Australia, Germany and Norway are among the countries that have ordered Sea Kings for use in anti-submarine, search and reconnaissance and air-sea rescue roles. Altogether seven countries are either operating or have ordered Sea Kings.

The AD580 Doppler Navigator forms part of a highly accurate avionics package, which includes radar and sonar, to enable the aircraft to carry out its maritime role in all operational conditions. By means of its three-beam transmission/reception pattern the AD580 is able to measure the three components of velocity and translate these into co-ordinates of speed, drift angle and vertical movement. The pilot is presented with navigation and control information on appropriate indicators and outputs are fed to the automatic flight system to assist automatic hover and other operational requirements.

An essential part of the aircraft's navigation/attack system, the AD580, is one of several sophisticated doppler equipments produced by Marconi-Elliott Avionics over the past 20 years – a period which has seen many millions of pounds' worth of these systems installed in civil and military aircraft. □

Expanding export order book

THE MINISTER for Aerospace and Shipping, Mr Michael Heseltine, visited the Rochester establishment of Marconi-Elliott Avionic Systems Ltd on Thursday, March 1st, 1973. He was accompanied by Mr H G R Robinson, Under-Secretary, Aerospace Research and Assessment, and Mr P J Graham, Private Secretary.

The major portion of his visit was spent in discussion with the senior management but he also made a short tour of the works during which he was able to see the company's facilities for producing the inertial navigation system for the joint Anglo-French Jaguar strike aircraft and the pilot's displays and other avionic equipment which have contributed to its export achievement. He was told that the company's export order book has expanded during the last two years and that orders from the USA had been a significant factor.

Afterwards he told the local press, "Marconi-Elliott Avionics is a very impressive company. What I've seen today very much confirms the impression I already had."

The Minister is pictured with Dr B J O'Kane, Chairman, and Mr J E Pateman, CBE, Managing Director, with the company's four Queen's Awards to Industry for Export Achievement in the background. □

OMEGA - the ultimate in navigation

Omega Ground Stations—approximate location

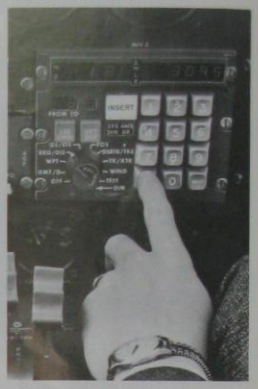
WORLD-WIDE AIRCRAFT navigation will be attainable accurately, reliably and relatively cheaply with the introduction of the AD1800 Omega automatic receiver by Marconi-Elliott Avionics. With the increasing demand for area navigation, growing congestion on air routes and cost-consciousness of both military and civil operators this system meets a very necessary requirement.

The AD1800, a fully automatic airborne Omega receiver/computer system, provides high accuracy navigation facilities for both civil and military operators on a world-wide basis. Its accuracy is comparable with that of an inertial navigation system but at an equipment and maintenance cost over 10 years of approximately one-quarter of those systems.

The AD1800 is the airborne element of the Omega long-range hyperbolic navigation system which is currently being implemented. Ground transmitting stations are being erected and complete world-wide coverage from eight transmitters will be available by early 1975. Coverage of many important air routes is already in existence from the four stations in use at this time and these areas will gradually increase as new stations are opened up and the existing stations are upgraded in power. The transmitter sites chosen are such that any position in the world will be in range of at least five stations at any time, with only three required to obtain an accurate navigation fix.

The AD1800 system has been designed by the Canadian Marconi Company and is also marketed by the Airadio Division of Marconi-Elliott Avionics. It consists of three units—a receiver/computer unit, an antenna/preamplifier and a control display unit. Together these form a complete system giving automatic and continuous read-out of aircraft position in one of several alternative forms, e.g. latitude and longitude, along/across desired track or bearing and distance to a selected waypoint. The appearance, operation and interwiring of the system is to ARINC 561 specification. Accuracy of Omega navigation using the AD1800 is of the order of 1 to 2 nautical miles c.e.p. anywhere in the world. All corrections (e.g. propagation variables etc) necessary to achieve this accuracy are carried out in the computer section.

Omega advantages lie in the very small number of stations required to provide world-wide cover and in long base lines giving excellent geometry with high accuracy. Both these factors are achieved by the use of very low frequency (VLF) ground transmissions. The cheapness of the AD1800 equipment relative to comparable navigation systems is also of obvious benefit to the operator and can be combined with the fact that all ground stations are erected, maintained and funded by the host countries with no charge to the user. By 1975 the full system will be implemented and a global navigation capability at minimal cost will be available to any operator. □



The AD1800 Control Display Unit on Airadio Division's Piaggio aircraft

T.V. for transport system control

Complete system for Brazil

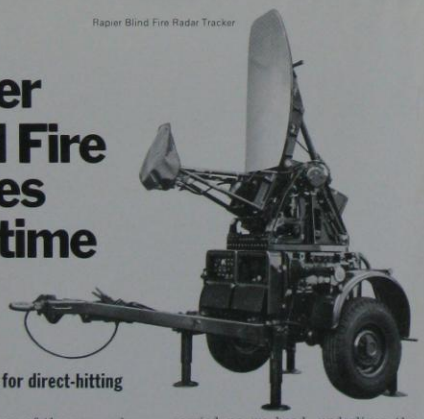
A MAJOR EXPORT order from South America has been won by Marconi-Elliott Avionics. The contract is for the television and video signal transmission system in the new São Paulo metro to provide the visual link essential to the smooth running of the automated control system of one of the most ambitious transport schemes undertaken in the world.

Marconi-Elliott Avionics were selected from international competition by Companhia do Metropolitana de São Paulo-Metro to be sub-contractor to Westinghouse Electric for the complete television system.

The system which the company is to supply will include television cameras strategically placed on each station on the 21 kilometre line and the video transmission system which will relay information to the central control, local station control points, and to the drivers of the trains. Central control and station supervisors will use pictures of passenger flow to prevent crowds building up to danger levels within the station. Cameras on the platforms will relay pictures to monitors on the platform beside the driver's position for checking that doors are clear before closing. □

Rapier Blind Fire Radar Tracker

Rapier Blind Fire scores first time



Radar tracking for direct-hitting missile

THE FIRST use of the new radar tracker, developed and manufactured by BAC and Marconi Space and Defence Systems Limited for the Rapier System, culminated in the destruction of the target. The occasion was a test with a Meteor target drone flying at M O.6 at a height of 2000 ft and engaged at a range of 6 kilometres. A major part of the precision tracking radar, forming the heart of the Rapier radar tracker, has been developed by Marconi-Elliott Avionic Systems Ltd.

The successful combination of a direct-hitting missile with radar tracking is a considerable technical achievement which has not been equalled anywhere in the world. It means that Rapier's impressive daylight operational effectiveness, repeatedly demonstrated during earlier trials, can be fully maintained by night or in poor visibility.

The destruction of the drone in the test, despite the fact that it quickly carried no warhead, underlines the soundness of the Rapier concept – a direct-hitting missile remaining supersonic up to the moment of impact.

The radar tracker is an optional extra for the standard Rapier system giving the operator the choice of optical or radar engagement depending on conditions. His choice does not have to be made until after the acquisition radar has indicated the presence of a target and, through a remote control link, has enabled the tracker to acquire the target.

The radar is mounted on a trailer identical to that used for the Rapier launcher and also includes other common components, thus simplifying logistical and maintenance support. The radar, which is towed by a long-wheelbase Landrover, has comparable cross-country performance to Rapier, and can be air-lifted by the same types of fixed-wing [illegible] □

Divisional Profile. 1

Powerplant Systems Division Linking digital computer technology with powerplant control

THE IMPRESSIVE developments of the past 15 years in digital component technology enable systems capable of accurately performing increasingly complex functions to be made available with less weight, less size, greater reliability and less cost. The result has been a rapid spread in areas of application. In particular, striking progress has been made towards control of aircraft engines whose operating principles can in the future make extensive use of sophisticated electronic control techniques. Very refined solutions to the engine control problem have been evolved using hydromechanical, electromechanical and electronic analogue methods.

In advanced installations, controls are required to regulate the whole range of powerplant functions including variable air intakes, fuel into the main burners, the reheat system, and exhaust nozzles. In addition the control system must prevent dangerous overspeed and overtemperature conditions.

It has long been recognised that digital computing technology has much to offer for such power plant controls. This stems from the ability to optimise a design in development by software modification rather than by more costly and time-consuming hardware changes. Marconi-Elliott Avionics have been conducting research in this field for the past ten years. At the beginning of the 1970s it became clear that digital computer solutions could be fully competitive with analogue solutions. It was also clear that in the future there could be an increasing integration of the controls for powerplant and for flight, especially for advanced STOL and [illegible]


DR JOHN BUSSELL was appointed as Manager of Powerplant Systems Division in April 1972. This appointment marked the end of nearly a decade of involvement in the application of digital computer technology to engine control. He has been concerned with analogue simulation in connection with nuclear reactors and guided weapons. In 1960 he took charge in Elliott of programming of the TSR2 central computer, the first major avionics application of digital computer technology in Europe. Since then he has been Chief Engineer of the Airborne Computing Division and then Manager of the Flight Automation Research Laboratory, both of Marconi-Elliott Avionic Systems Limited.

In view of the company's experience in both fields it was decided that a stage had been reached to create a new division to be responsible for developing the powerplant control market area and to identify the directions of future research and system development. This new division, Powerplant Systems Division, has been created at Rochester and is responsible for this area of the company's business. It is rapidly becoming established, with its own team of systems engineers who apply the Marconi-Elliott Avionics experience and expertise in high integrity instrumentation and control. □

Growing interest in Jaguar NAVWAS

AS THE production programme builds up for the navigation and weapon aiming system (NAVWAS) for the Royal Air Force Jaguars there is a growing interest in the system on the part of overseas Air Forces. Based on market studies made in the past few months it is forecast that sales of the system, Europe's first digital NAVWAS, could exceed 700 systems during the next few years.

Flight testing of the NAVWAS equipments for the joint Anglo-French Jaguar has produced results showing that performance in both navigation and weapon aiming is well inside specification. These flights, from BAC's Warton airfield, are part of a series of acceptance tests of the Marconi-Elliott Avionics system which includes an E3R inertial platform and a 920M digital computer. So far systems have been flown in eight aircraft and during more than 600 hours of flight testing the equipment has performed with a reliability better than is normally encountered during the early stages of flight testing such equipment.

Complete testing at factory

The equipments used in the present service acceptance trials have been delivered from the production line at Rochester. Deliveries are now taking place at an increasing rate and special facilities for Reliability Shakedown Testing (RST) and Systems Integration Test (SIT), installed in the company's Inertial Navigation Division responsible for Jaguar NAVWAS, are now working continuously seven days a week to ensure that requirements for production aircraft are met. These facilities have capacity to process the "black boxes" at greater rates to meet the future needs of the Royal Air Force and of overseas Air Forces. □

Principal components of NAVWAS with Jaguar Prototype 507

Installation of chambers for environmental testing of inertial navigation units

Focus on Technique. 1

Cluster rotation reduces inertial navigation errors

A MAJOR COMPONENT of gyro drift is associated with the mechanics (or electro-mechanics) of the gyro structure. Factors such as friction at a particular part of the wheel pivot or misalignment of the torque vector due to irregularities in the torque motor windings give rise to drift vectors whose direction and magnitude are determined by these factors.

Imagine a gyro at the centre of a clock. Its natural tendency, due to friction, etc., is to drift towards, say, 12 o'clock. By rotating the whole gyro this tendency will, after half a cycle of rotation, cause the instrument to drift towards 6 o'clock. This carousel effect, or cluster rotation, commutates the effect of gyro drift and enables us to use gyros which have existed for many years but which can now be used to achieve system accuracy beyond that normally accessible by these instruments.

This rotation technique is not new. In 1800 a Monsieur Abraham Louis Breguet of Paris, an inveterate inventor and famous watchmaker, patented "Tourbillon" escapements which used the rotation technique to cancel out position errors in his watches. The term "karrusel" was probably first used by Bonniksen who invented a more compact arrangement of Breguet's Tourbillon and in which the escapement was rotated through 360 degrees every 52½ minutes.

Cluster rotation is employed in the E3R inertial platform as used in the Jaguar NAVWAS system by Marconi-Elliott Avionics and in a similar way by Delco Electronics in their Carousel 4 inertial navigation system for civil aircraft.

Doug Harris, Chief Engineer, Inertial Navigation Division, Marconi-Elliott Avionic Systems Limited, created a lot of interest at a recent Agard meeting with his paper on "The Use of Spatial Commutation of the Horizontal Inertial Sensor Errors." □

Supergyro for Europe

Proven in 77 US projects

SUPERGYRO has been applied in 77 US projects including:

- Helicopter Optical Sight Stabiliser
- "TALOS" Ship-to-Air Missile
- "MAVERICK" Air-to-Surface Missile
- "AEROBEE" Sounding Rocket
- Mk 48 Torpedo

THE WELL-PROVEN rate gyro – SUPERGYRO – will be made available in Europe by Marconi-Elliott Avionics through an agreement with Hamilton Standard Division of United Aircraft Corporation. Preparation for production is now under way at the company's Rochester factory.

This unique design of rate gyro involves about 40% less parts than a comparable gyro and achieves reliability and ruggedness at about 20% less cost. Suited to the testing environments of rockets and underwater missiles it has a greater range of applications than a comparable gyro.

All these characteristics have lead to the selection of SUPERGYRO for 77 US projects to date.

Its application capability can be gauged from the selection of some of these projects printed opposite.

SUPERGYRO is now being evaluated for European applications in Germany, Sweden, Switzerland and UK and has been proposed for projects in France and Italy.

This latest addition to Marconi-Elliott Avionics' range of rate, vertical and azimuth gyros, accelerometers and multi-axis sensor packages, will be handled by the company's Gyro Division at Rochester, which can also supply all associated electronic packages. The Division plans to have SUPERGYRO in production in mid-1974. □

Local Interest

Basildon-New Town

TWENTY-FIVE YEARS ago the main London to Southend road ran past the tiny village of Basildon – a typical south Essex hamlet with a few houses and a lot of open space. Today, Basildon New Town is the centre of a vast urban development with a large industrial complex and a population approaching 100,000. It is also the home of the Airadio and Electro-Optical Divisions of Marconi-Elliott Avionics who moved there from Chelmsford in the early 1950s.

Basildon New Town is a first-class shopping area and is only 35 miles from the centre of London and 10 miles from Southend-on-Sea, which is itself undergoing large changes in town layout. A little farther along the coast lies the site of the proposed new London Airport on Maplin Sands. The whole area is steeped in history and has been the arrival point for scores of invading armies from Europe during pre-historic and mediaeval times. Amongst the many sporting facilities available, the foremost is probably that of sailing from harbours such as Burnham-on-Crouch and Maldon and the numerous creeks and inlets of the rivers Crouch and Blackwater. □

LASSIE evaluated by Edwards AFB

A NEW SYSTEM of measuring helicopter airspeed has been evaluated by the US Army Aviation Systems Test Activity at Edwards Air Force Base in California. Named LASSIE (Low AirSpeed Sensing and Indicating Equipment), the system, developed by Marconi-Elliott Avionics, for the Royal Aircraft Establishment, Farnborough, where evaluation is also being carried out, comprises a sensing probe, airspeed computing unit and a forward and aft airspeed indicator. It is also undergoing evaluation at the Royal Aircraft Establishment, Farnborough. The Edwards A F B evaluation report concludes:

"The system provides reliable, accurate airspeed data from hover to 120 knots in the direction for which the sensor is mounted, and results indicate an omni-directional system is feasible. The system is simple, is highly reliable, should be relatively inexpensive in production quantities and has high potential for development into a standard aircraft instrument. In addition to airspeed information, the system can provide data on downwash velocity, direction, and aircraft performance through measurement of induced flow."

Although the Edwards A F B testing did not extend beyond 120 knots the Marconi-Elliott Avionics LASSIE system has a design range of measurement extending from 30 knots rearward to 200 knots forward.

A further development of the system, LASSIE 2, currently under evaluation at Edwards A F B, is an omnidirectional system which can measure sideways flight in both directions up to 30 knots. This system incorporates an additional indicator for sideways airspeed.

LASSIE developments are dealt with by the Instrument Systems Division at Rochester. □

LASSIE AirSpeed Sensing probe

Concorde 02 automatic landings

Autopilot Control unit

CONCORDE 02, the newest pre-production aircraft, made a successful automatic landing at the completion of its third flight at Toulouse, France. In spite of moderate turbulence the aircraft performance was sufficiently accurate for the crew to allow an automatic landing on the first automatically coupled approach.

Since then, pre-production Concorde 02 has made two more automatic landings and the Toulouse prototype aircraft 001 has now completed over 60 automatic landings, including 11 successful landings in one day.

The automatic flight control system in the two prototype and two pre-production Concordes has now controlled the aircraft in all the planned manoeuvres, speeds and heights that will be met in airline service. The system performs 33 functions giving automatic control of climb, acceleration, cruising, navigation, height changing, deceleration and landing.

The dominant feature of Concorde cockpit presentation is the Autopilot Control Unit mounted in prominent position visible to all crew members. This control unit (illustrated left) enables the pilots to control all the automatic functions and clearly indicates the status of the automatic control system.

The manufacture of Concorde AFCS is shared equally by Marconi-Elliott Avionic Systems Limited and its French partner SFENA (Société Française d'Equipements pour la Navigation Aérienne). □

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