



No.1

ELLIOTT FLIGHT AUTOMATION LIMITED

March 1967



BAC One-Eleven G-ASYD, in which the Category 2 low-approach system was flight tested, is here making its final landing at Hurn before being divided into three portions and "stretched" as the One-Eleven 500 prototype. It had then made automatic landings with the 2100 Series autopilot.

## Hands-off Landings for Three Airliners

### Elliott Systems Pass Development Landmarks

Automatic landings in passenger-carrying service were brought a big step nearer by completion of the flight test programmes in the Super VC10 and BAC One-Eleven, respectively in January and November. The Concorde system has also progressed on schedule with delivery of the first system to France.

On January 19, a management team from BOAC headed by Sir Giles Guthrie, the airline's chairman, flew for 75 minutes in Super VC10 G-ASGG and they experienced three very smooth automatic landings at RAE Bedford, despite strong crosswinds and turbulence. Afterwards, Sir Giles said "I was very impressed . . . the landings were excellent, although conditions were as bad as could be expected . . . I know that BAC and Elliotts have developed a British system which leads the World."

After completing an intensive flying programme in only 20 weeks, the BAC/Elliott team have shown that the VC10 system is acceptable

for passenger-carrying automatic landings. BOAC now claim that they will be the first airline to use a fully automatic landing system in scheduled service. All Super VC10s will be equipped. G-ASGG is now in the hangars at Wisley, after more than 660 automatic landings.

#### . . . and One-Eleven

The Elliott 2000 Series autopilot in the BAC One-Eleven is already in service with airlines all over the World and will remain standard equipment in the latest version, the One-Eleven 500 now ordered by

## MR KOSYGIN MIGHT NOT HAVE BEEN DIVERTED

*EFA made its case at Borehamwood*



The Russian Prime Minister was obviously pleased as he held up the cuff-links presented to him by Sir Leon Bagrit, Elliott-Automation Group Chairman, on behalf of the company. Between them is Mr. Wedgwood-Benn, Minister of Technology and, on the extreme left, is Mr. T. B. M. Rybak, director and general manager of Elliott-Automation (International) Ltd.

LOOKING at part of the Concorde autopilot in the special exhibition prepared at Borehamwood for his visit on February 8, Mr. Alexei Kosygin, the Russian Prime Minister, observed that if his aircraft had been fitted with an automatic landing system he would not have been diverted from Gatwick to Heathrow. He was obviously equally impressed by the other equipment he was shown, which ranged from several lasers to an air cushion system for moving 100 lb sacks along ramps with the pressure of one hand.

Mr. Kosygin was accompanied by Mr. Wedgwood-Benn, Minister of Technology, and was received by Sir Leon Bagrit, Elliott-Automation Group Chairman and members of the Board. It was a great occasion for Elliotts, the only company visited by Mr. Kosygin during his week in Britain. EFA was prominently represented, with the E.5 inertial system, head-up display, Concorde engine instruments, fuel flowmeter, air data sensor and quadruplex failure-surviving actuator.

### EFA NEWS

Do you know what's happening in the next tower? or on the other side of the airfield? or in the main works? EFA NEWS is here to tell you — about technical, commercial and social activities at Rochester and about the whole pattern of events which are putting EFA ahead of the competition.

The desolate post-TSR.2 days are far behind us now. EFA has rebuilt its order book and broken into new markets with new products. But these very successes have tended to shut people off in watertight compartments. EFA NEWS intends to break down the information barrier. Your success deserves to be known throughout the company: knowledge of success somewhere else in the factory may cheer you in your present problems.

EFA is people. Development, production and sales depend on people first and foremost. EFA NEWS is here to make EFA people known to each other — approximately every two months, free of charge.

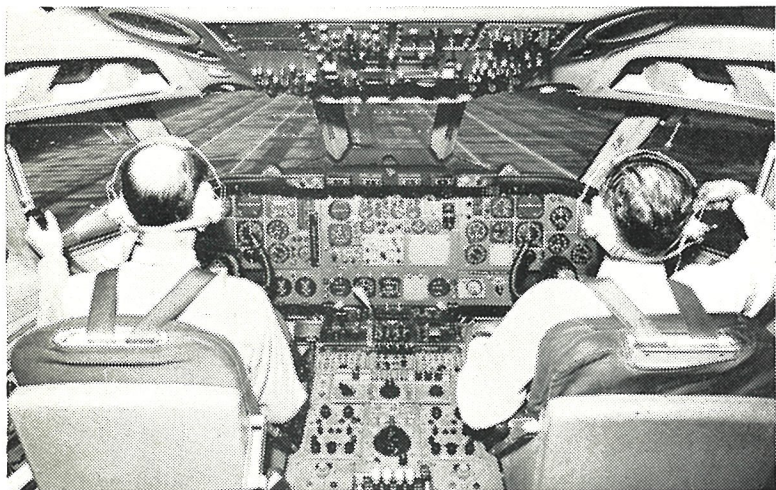
### GIFT OF SILICON CHIP CUFF-LINKS

Mr. Kosygin was given a pair of cuff-links bearing silicon chips on which the Russian words "Welcome to Alexei Kosygin" were etched in letters only four microns high. This is the process used for manufacturing Elliott microcircuits at Cowdenbeath, Scotland. The message could only be read through a microscope.

The public impact of Mr. Kosygin's visit to Borehamwood was confirmed by this Whitford cartoon in the Evening Standard. Elliott computers are clever, but . . .



"It says: Trotsky is still alive and living in South America"



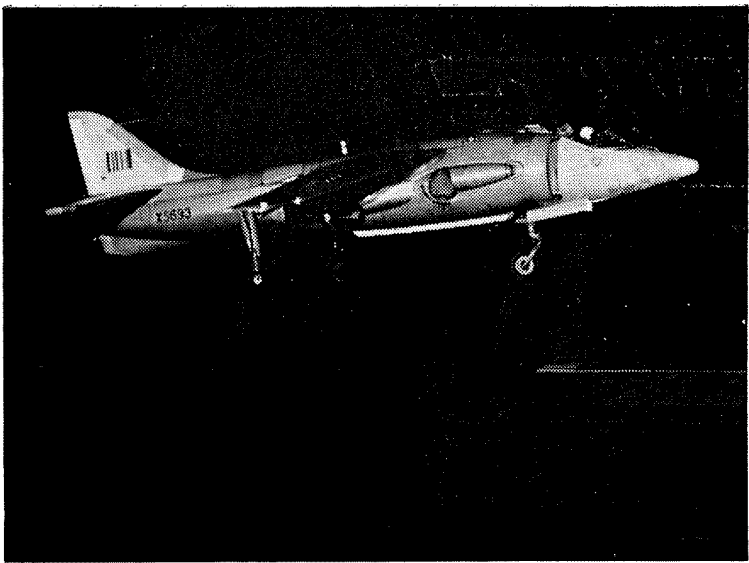
The final moments during one of the 660 automatic landings in the Super VC10.

#### . . . and Concorde

A complete Concorde flight control system, including autopilot, flight director computer, take-off director, autostabiliser, autothrottle and electric trim has now been delivered from Rochester to Sud-Aviation at Toulouse. This first system will be installed in the "iron bird" pre-flight simulator rig during the coming months, and much of the system will fly in the Concorde prototype when it makes its first flight at Toulouse on February 28 next year.

SFENA in France and Bendix Eclipse Pioneer in the U.S.A. are co-operating in development of the Concorde flight control system.





In conditions like this, landing vertically at night with no more than kerosine flares for guidance, the Hawker Siddeley P. 1127 pilot will be assisted by his Elliott two-axis autostabiliser.

# World First in Stabilisation

## EFA Control Flies in P. 1127

**Hawker test pilot Hugh Merewether reported fully satisfactory performance after the first test flights with the EFA two-axis autostabiliser in the P.1127 V/STOL close support aircraft.**

This is the first autostabiliser ever to be fitted in a production VTOL aircraft, and represents a new departure in size and compactness. Gyros, power supplies and computers, together with a full self-test facility, are contained in a single dwarf  $\frac{3}{8}$  ATR short case.

This is MACD's second venture in the VTOL stabilisation field, the first being the high-integrity, failure-surviving system successfully flown in the Fiat G.95/4 flying bedstead.

The P.1127 can be flown comfortably without artificial stabilisation, but the Elliott system will greatly help squadron pilots in difficult weather or load conditions.

Production deliveries are due to begin in the middle of this year. The computer has independent roll and pitch autostabilisation

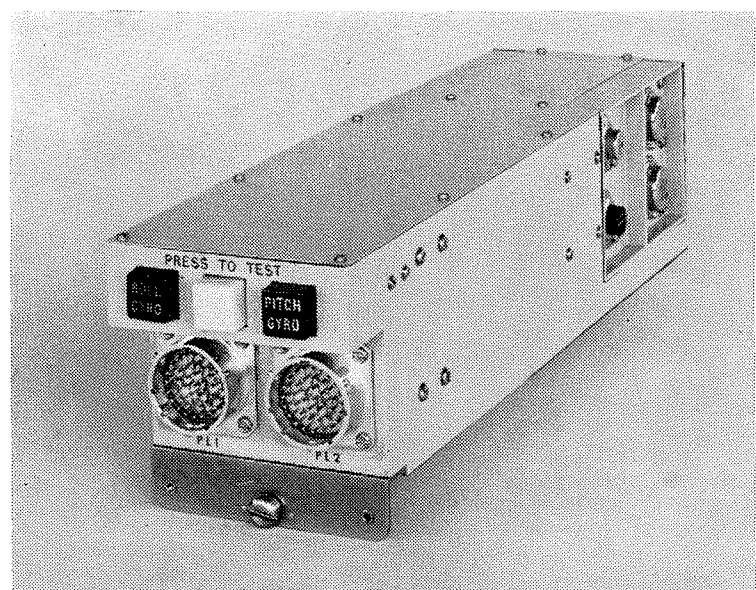
channels, and incorporates rate gyros, power supplies and a self-test facility.

The dwarf ARINC  $\frac{3}{8}$  ATR short case is constructed from flat sheets by dip brazing and contains a number of easily replaceable sub-assemblies. Of the two covers, the top one gives access to the gyros, plug-in circuit cards and power supplies, and the bottom cover gives access to the wiring.

The plug-in cards, which are double sided printed circuit boards with plated through holes and edge connectors, carry a number of plug-in modules. Each module consists of a complete circuit, such as a d.c. amplifier or a demodulator. To achieve maximum packaging density, welded joints are used in the modules and soldered joints on the cards. Discrete components are used on the power supply cards.

Test points are provided on the unit connectors to facilitate second line servicing.

Dimensions 3.56 in  $\times$  3.12 in  $\times$  12.56 in (9.05  $\times$  7.95  $\times$  31.93 cm) Weight is less than 6 lb (2.85 kg)



# PRODUCTION ORDERS FOR C-5A UNITS NOW TOTAL \$4.5m

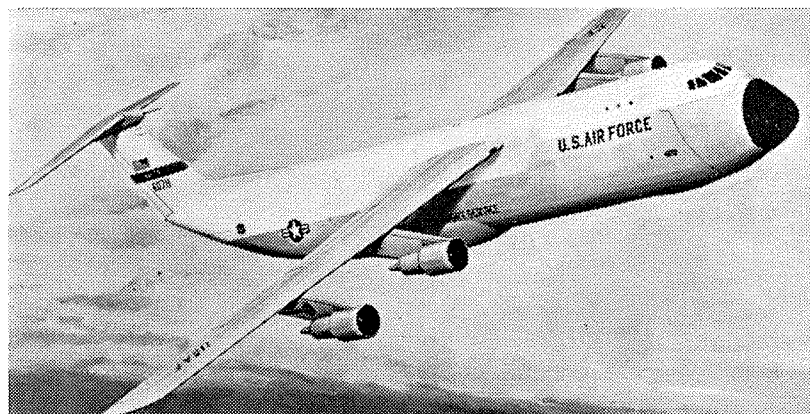
## Three Elliott Systems for Giant USAF Jet Transport

**Firm orders for Elliott equipment for the first 58 Lockheed C-5A heavy logistics transports, the largest aircraft in the World, now total \$4.5m. Gained in open competition with the major US manufacturers, these orders put EFA firmly on the American map and the sales team is working hard to gain other orders.**

The orders for Phantom equipment gave Elliotts the first taste of American methods and procedures. The order to develop the digital head-up display for the US Navy Integrated Light Attack Avionics System was the first major breakthrough into the purely American defence electronics market. The orders now held from Lockheed represent quantity production and are an acknowledgement that Elliotts can produce the right equipment at the right price.

The three systems now being prepared for the first 58 C-5As are the air data system, the undercarriage alignment control and the energy management analogue computer (EMAC), involving the products of three different EFA divisions, FID, TACD and MAC.

Undercarriage alignment is quite an involved task. The C-5A has four main undercarriage legs, each carrying six wheels. The Elliott control allows the pilot to swivel the main and nosewheel legs together so that the giant aircraft can land in a cross-wind without correcting the

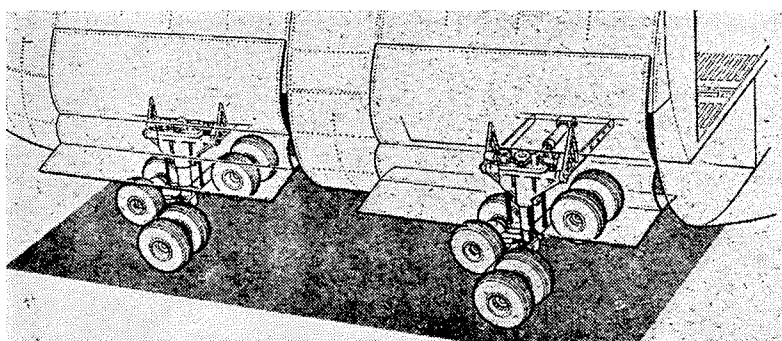


380 tons gross weight and 58 ordered — this is the Lockheed C-5A heavy logistics transport aircraft, for which EFA is providing three types of control equipment.

drift. Immediately after touchdown, the system automatically swivels the legs to realign the fuselage with the runway, but the pilot can at the same time steer the aircraft. While taxiing, the rear main legs have to swivel to prevent the wheels being scrubbed sideways. A fully loaded C-5A weighs 380 tons and each main leg is carrying something like the weight of a loaded BAC One-Eleven on rough ground. The leg-swivelling system must be monitored so that no leg can swivel "out of step".

The EMAC system calculates for the crew at any time during the flight how far the aircraft can fly, on four or three engines, and at what height and Mach number it will achieve best range or endurance. It will also show the effect of changing height and speed. The C-5A has a maximum fuel capacity of 49,000 US gallons, weighing more than 159 tons, and can fly for a maximum 7,200 nautical miles. EMAC has a job to do.

The US Air Force has so far ordered 58 C-5As, but it has an option on another 57 and up to 200 might eventually be needed.



The Elliott undercarriage alignment control has to swivel the C-5A's undercarriage legs, two of the main six-wheel bogies of which are shown in this "Flight International" drawing. Each carries a weight equivalent to that of an airliner.



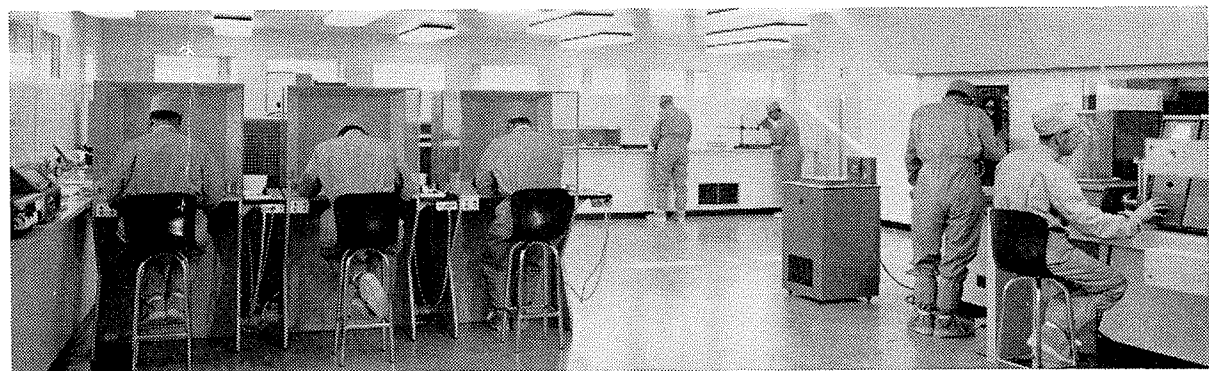
## NEW BUSINESS FOR GYRO DIVISION

Dick Scott and the Gyro Division team have landed a major contract for Elliott Nortronics sub-miniature rate gyros to be used in the television guidance head of the Anglo-French Martel air-to-surface missile. The ultimate value of the order is expected to exceed £900,000. Competition for this type of contract is always very tough.

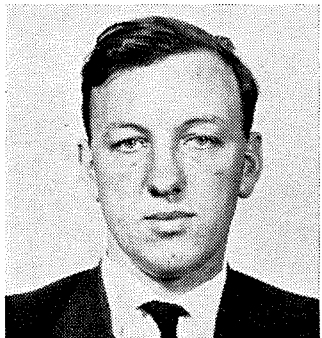
The gyro is contained in a 1 in  $\times$  2 in cylinder and is extremely accurate and strong. It is fluid damped, but requires no heater controls.

EFA has now made more than 500 gyros of this type, and other applications include the Sea Dart ship-to-air missile, the autostabiliser for the Hawker Siddeley P. 1127, and the Sea Vixen carrier-borne interceptor. Many more applications are likely.

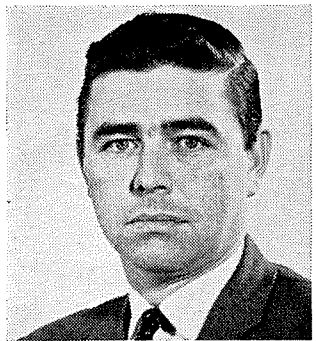
The sub-miniature rate gyros being assembled and tested in the Gyro Division super clean area in the tower block.



## EFA people on the way up



**Ray Reese:** Divisional Manager,  
Aircraft Engine Instruments Division



**Derek Jackson:** Chief Engineer,  
Military Aircraft Controls Division

**John France:** Chief Engineer,  
Aircraft Engine Instruments Division

**Doug Harris:** Chief Engineer,  
Inertial Navigation Division

**Len Cobley:** Production Manager,  
Aircraft Engine Instruments Division

**John Goodhand:**  
Assistant Production Manager,  
Military Aircraft Controls Division



EFA's annual Over 50s Cocktail Party this year, held in one of the canteens, assembled some 400 guests, including the retired members of the Over 65 club. The Over 50s have been in being for seven years, and the Over 65s were formed in 1965 — for over-65s.

Seen above enjoying themselves at the Cocktail Party on February 18, are Mr. and Mrs. W. Kemp and Mrs. Collins, wife of Elliott's social club secretary, Jim Collins. Bill Kemp has been an Elliott-Automation member for more than 20 years and is chairman of the Shop Stewards' Committee.

**We are quite sure that this news item in the Financial Times did not refer to the activities of the Elliott Flying Club:-**

*"Police yesterday sought six pairs of women's bloomers — part of mini-dress bloomer sets — which fell from a light aircraft over Kent. It's the craziest request to-day, said the police. We're treating it as a normal case of lost property."*

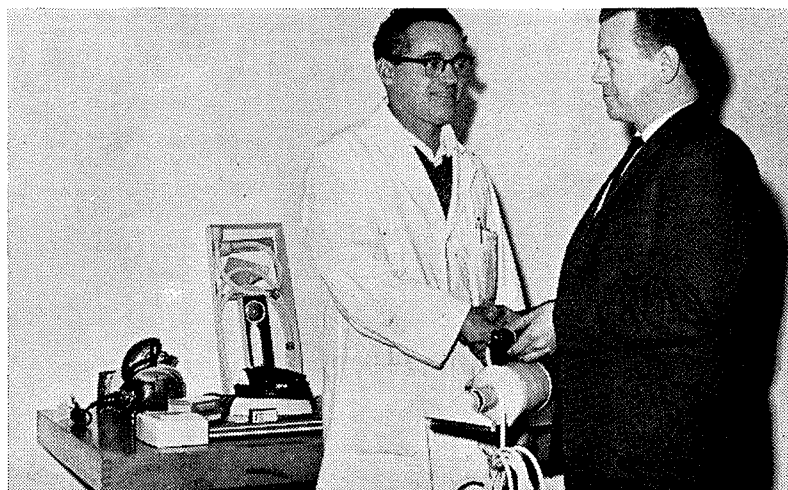
*The pilot opened a side window to demist his windscreen. The wind caught the bloomers and blew them away, he said."*

## HOBBIES... Take your pick

A great variety of sports and hobbies are covered by the EFA Social Club at Rochester. For the princely sum of 3d. a week you can join any number of the special sections. Here are fourteen of them, together with the organisers:-

Cricket	Mr. Johnson	Gyro Model Shop
Athletics	Mr. Murphy	Gear Division
Archery	Mr. Milner	Fuze DO
Auto	Mr. Walliker	IN
Model Engineering	Mr. Barratt	IN
Rifle	Mr. Bloodworth	MACD
Camera	Mr. Babbington-Brown	TACD
Judo	Mr. Walker	Fisher Machine Shop
Tennis	Mr. Young	TACD
Swimming	Mr. Crisp	Fisher
Weight Training	Mr. Cox	MACD
Karate	Mr. Johnston	Fuze DO
Soccer	Mr. Flood	Fisher Welding
Table Tennis	Mr. Sands	Sheet Metal

Every Friday night the Social Club holds a "beat night" in the club house in Gillingham. This is an extremely popular occasion and members are asked not to bring more than one guest. The evenings are organised by the Elliott Social Club's secretary, Mr. Collins.



## POWER OF SUGGESTION

Mr. Lane of Central Machine Shop thought up one of more than 140 suggestions for manufacturing improvements at Rochester during 1966. He developed an extractor for clearing waste material away from the drill in a circuit board-drilling operation, which reduced drill breakages and machine overhaul time.

The Suggestions Committee chose this as the best suggestion of the year and presented Mr. Lane with £30 worth of electrical equipment. The presentation was made by Mr. Reg Collins, Manager, Central Machine Shop.

## A REMINDER DON'T GET CAUGHT

All cars more than three years old will need an MoT Certificate from April 1. All things being equal, the test and certificate will cost you 15s.

## ARE YOU OVERWEIGHT?

Then follow this simple diet. It has been environmentally tested by a member of MACD. The man in question swears by it, so if you see the ghost of a former portly gentleman flitting through the Division, you can judge for yourselves.

You may eat as much as you like of a large number of foods, but you must be VERY firm in cutting down on foods which contain starch or sugar.

### You may eat as much as you like of:

Meat, fish, eggs, cheese. Butter, margarine, cream, oil. Green vegetables. All sorts of meat, fat or lean. For example, you may eat the fat of chops, bacon or ham. Any sort of fish you like, including sardines, mackerel, herring and salmon. You can have your eggs, meat or fish cooked in any way you like so long as you do not have them covered in flour batter. You can have French dressing on your salad, or your vegetables braised in butter, margarine or oil.

### You can drink as much as you like of:

Tea, coffee, meat extract. Do not exceed your milk allowance and do not, of course, add sugar.

### You can have restricted amounts of:

Milk — up to one pint a day.  
Potatoes — not more than 2 medium-sized potatoes a day.  
Peas, beans, carrots — not more than twice a week.  
Fruit — not more than 2 pieces of any fruit a day, but no bananas.  
Starch-reduced rolls — up to 6 a day.  
Starch-reduced crispbread — up to 3 pieces a day, but see that the product is definitely labelled "starch-reduced".

### YOU MUST AVOID:

Any food with starch or sugar — the only sugar substitute you are allowed is saccharin and not sorbital or glucose or honey: bread, including wholemeal bread, and toast: cakes, pastries, biscuits, sweets, chocolates: rice, spaghetti, macaroni, sago, semolina: tinned or frozen fruits in sugar or syrup: sweetened fruit drinks or other soft drinks: any drink containing alcohol.

## ? IS IT TRUE

That John Gausden considers living out of a suitcase the "in" thing.

★  
That a certain divisional manager with a Lotus Cortina thinks the speed limit is 110 m.p.h.

★  
That the sales manager of DADD prefers garaging his car on the Continent.

★  
That Alf Harrison's New Year resolution was that no swear word would pass his lips.

★  
That a certain chief draughtsman told a project administration officer that he had been allowed too many hours for a job.

★  
That a certain divisional buyer was seen buying his own lunch-time beer at the "George".

★  
That Frank Bevan went to Japan for a bath . . . . and why did six TACD people go there for a bath?

★  
That a queue has already formed behind Bill Alexander for the Paris Air Show.

★  
That an interpreter is needed in DADD since Doug Gemmell's appointment as chief engineer.

★  
That the Playboy Club has given Don Moore-Searson special rates.

## ? DO YOU KNOW

### YOUR BLOOD MAY SAVE A LIFE

A Blood Donor Unit will be in the main canteen from April 10 to 14 inclusive.

Blood donorship is quick and painless: it costs you nothing. It will almost certainly save someone's life. Surely this is an essential service you personally can perform.

Make your appointment now through either of the works surgeries.

### ON-THE-SPOT MEDICAL HELP

If you feel ill at work or have an accident you can go to one of two fully equipped surgeries in EFA. The main surgery is in the main works hangar — just follow the First Aid signposts. The other surgery is in the Flying School area. Hours of business are:-

### MAIN SURGERY — OPENING HOURS

Mon., Wed. and Fri. — 7.30 a.m.-5.00 p.m.  
Tues. and Thurs. — 7.30 a.m.-6.30 p.m.  
Sat. — 7.30 a.m.-12.30 p.m.

### FLYING SCHOOL SURGERY — OPENING HOURS

Mon. to Fri. inclusive — 7.30 a.m.-5.00 p.m.



# AUTOMATIC TESTING BREAKTHROUGH

*Computer-Controlled System for HS. 801*

A major advance in the technique of automatic testing of airborne equipment has been confirmed by the recent order for several C700 automatic test installations, each controlled by an Elliott 900 Series digital computer, for the RAF HS.801 maritime aircraft programme. More than 50 different HS.801 "black boxes" will be tested by programmes stored and run by the computer, and this capacity can readily be extended to cover thousands of circuit modules as well as complete boxes.

Major advantage of the digital computer in this application is its greater speed and accuracy, and its ability to store test programmes. But another innovation in the C700 is the provision of a cathode-ray tube tabular display on which test results and instructions can be written by the computer. The operator will therefore have explicit information and instructions, instead of having to refer to indexed sections of test manuals. The display is produced by Elliott Space and Weapon Automation Ltd. at Borehamwood.

## Airline Potential

While the RAF order, worth nearly £1m., is an important factor in establishing the C700 in military service, the equipment also has a special interest for civil airlines. For the first time it offers the ability to test all the airborne equipment in a modern airliner, including inertial navigator, radio and radar. A comprehensive installation would include a high-speed random access programme library controlled by a separate 900 Series computer, feeding test programmes to individual functional test bays, each operated by its own computer.

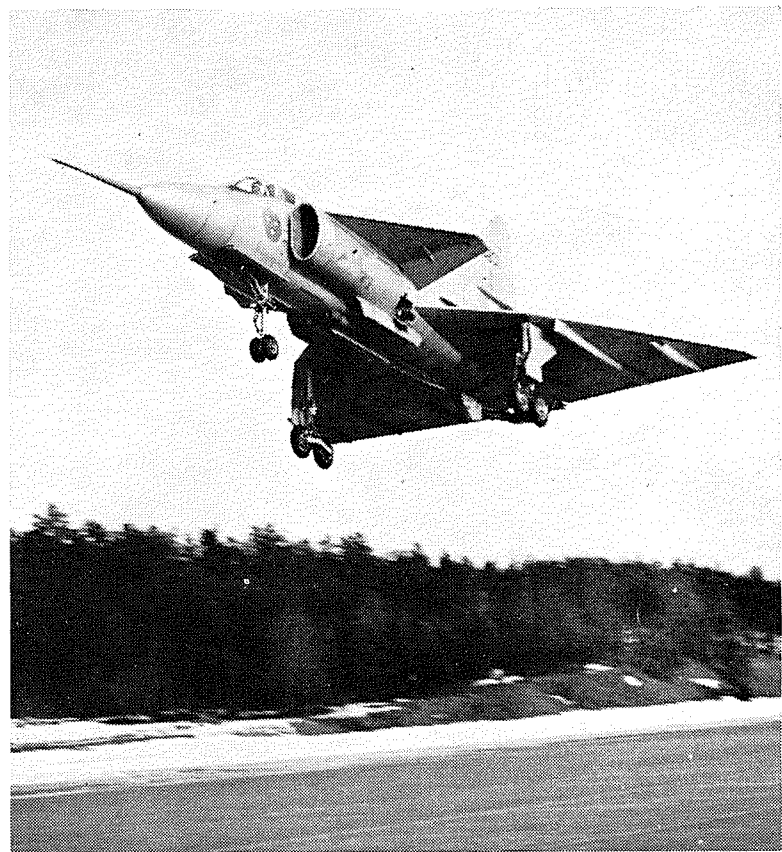
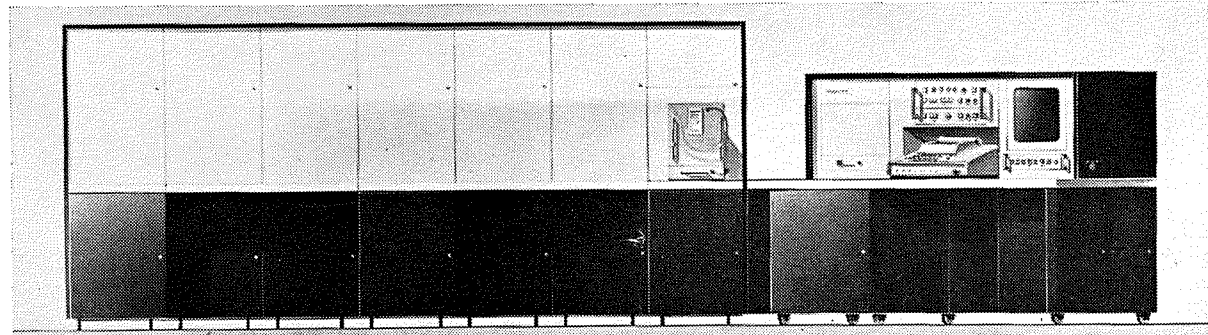
Automatic testing is rapidly becoming an accepted technique in civil airline maintenance areas. Sales of installations capable of testing certain types of airline equipment, such as autopilots, are mounting steadily. The C700 makes it possible to test all types of airborne equipment with one installation. For the advanced airliners now projected, such as supersonic transports and jumbo jets, such a capability may well become absolutely necessary if spares holdings and equipment turn-round times are to be kept at reasonable and economic levels.

Automatic testing greatly reduces the time required for routine testing of equipment after removal from the aircraft. As often as not, the equipment proves to be serviceable but only testing will prove it. Automatic testing is not only faster, but requires less skill and releases highly trained staff for repair and overhaul work, where their abilities can be more effectively applied.

With C700, EFA is ready to take an important share of the large market for "second generation" automatic test equipment. It is Elliott's ability to match experience of the process with on-line operations which has made this new 900 Series application possible.



Off to the USA late last month Commander H. Pasley-Tyler, Director and Group General Manager of Elliott-Automation, and Chairman of EFA, ESWAL and E-ARS, the three companies mainly concerned with aviation. He was leading an Elliott/Plessey/MoT/RAF sales team to give the Pentagon the low-down on Nomad. Already ordered for the RAF, Nomad is a computerised, mobile air defence system for which there is at present no working American equivalent.



## Thor's Three-forked Lightning

First take-off by Sweden's Saab AJ37 Viggen tactical fighter from Linköping airfield on February 8 was a major landmark in the development of Sweden's most ambitious military programme to date. Viggen is Thor's three-forked lightning and the aircraft has the triple role of interception, attack and recon-

naissance. The most advanced military aircraft now flying in Europe, the Viggen is to have an Elliott head-up display to help the pilot aim his weapons and to facilitate the difficult manoeuvre of landing at very low speed, in a high-drag condition, on prepared stretches of road only 500 yds. long. The secret of this performance is the delta foreplane, with blown flap, clearly visible in this picture. Several development head-up displays have already been delivered to Sweden. Other Elliott head-up displays are already fitted in all Buccaneers and Belfasts, and DADD is developing the special digital display for the US Navy's Integrated Light Attack Avionics System. The all-ceramic tube developed by Elliott Microwave Ltd. is an essential part of the latest head-up displays.

## STILL DRONING ON...



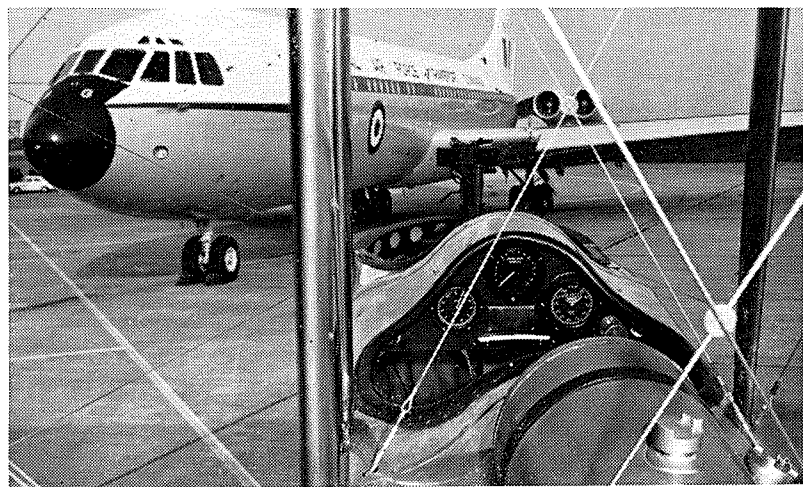
Remote controlled autopilots produced by MACD for Jindivik target drones have now seen many years service at RAE Llanbedr, which provides target drone service for the MoT Aberporth rocket range and for the Army range at Ty Croes. Above is one of the latest Jindiviks on its take-off trolley during final pre-flight tests. The "pilots" control the drone from the wheeled cabin in the background. RAF personnel control the drones in flight and civilians provide ground services. One Llanbedr Jindivik holds the world record for drone longevity with more than 70 sorties. The Jindivik is also in service in Australia, the USA and Sweden.

## FIFTY YEARS' ASSOCIATION WITH RFC and RAF

More than 50 years' association between Elliotts and Vickers Armstrongs, and between Elliotts and the RAF are represented by this picture of the rebuilt Vickers Gun Bus, which flew during last summer, and an RAF VC10 transport. Most of us know that the VC10 has the Elliott autopilot, but many people may not realise that Elliott Brothers (London) Ltd. manufactured large numbers of flight instruments during World War I, including those for the Gun Bus.

For the Gun Bus replica, Elliotts provided remade altimeter and airspeed indicator and an original inclinometer tube, overhauled after being used as a paper weight in the intervening years.

To confirm EFA's after-sales service and confidence in its products, Mr. Hanbury Brown, then manager of FID, wrote the following letter to the "Vickers Aeroplane Company" at Weybridge:—



Dear Sir,

**"FB.5 (Gun Bus) Flight Instruments**

"We thank you for your esteemed order of 1912, the reference number of which is uncertain, and have pleasure in sending by horseless carriage an altimeter Mk IVA, airspeed indicator Mk IVA and inclinometer No. 627956. These instruments are as supplied by us to other pioneer aviators whose machines have proved eminently satisfactory and we trust that they will give you at least 54 years of service, which is our normal period of guarantee. . . .

"If you consider it likely that your machine will go into quantity manufacture for military purposes, we shall be happy to quote you a special price for quantities in excess of 1,000."

Published by Elliott Flight Automation Ltd., Airport Works, Rochester, Kent. Designed and produced by Lovell & Rupert Curtis Ltd.