

Sightseers on the Cornish coast watch the smoke rise from Torrey Canyon

## Displays and Autopilots in Torrey Canyon Strike

# EFA IN THE FRONT LINE

**P**PROMINENT among several score Royal Navy and RAF aircraft engaged in the great operation to destroy the thousands of tons of oil leaking from the super tanker Torrey Canyon aground off Lands End were eight Buccaneer S.2s. Their bombs, placed accurately on the stricken wreck, started the conflagration which consumed much of the remaining oil. Smoke rose to between 15,000 and 20,000 ft. as people on the shore looked on (see picture at left).

EFA equipment played an essential part in the delivery of about 150 of the 1,000 lb. high-explosive bombs, one of which is reported to have plunged directly down the smoke-stack of the Torrey Canyon.

Lt. Cdr. David Mears, RN, Senior Pilot of 800 Squadron flying Buccaneers from Lossiemouth in Scotland, told EFA NEWS that both the Elliott autopilot and the head-up display were used during the operation. Buccaneers from 800 and 736 Squadrons flew direct to the Seven Stones rocks from Lossiemouth and returned to Brawdie, in south-west Wales, to re-arm for further attacks. Each evening, they flew home to Lossiemouth.

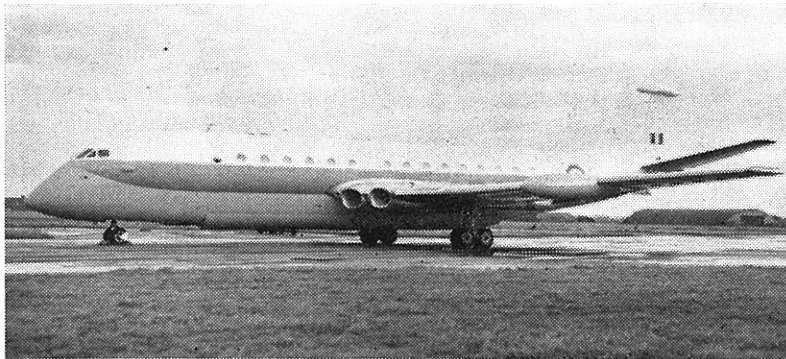


Lt. Cdr. David Mears, who told EFA NEWS about EFA equipment in the Torrey Canyon operation, is followed out of a Buccaneer at RNAS Brawdy by his observer, Lt. Reardon

# New Era in Ocean Patrol

## EFA Prominent in Advanced HS.801 Systems

**O**UT in the sunlight now and beginning flight testing is the whale-like, but highly significant Hawker Siddeley HS.801 maritime aircraft—unofficially known as the Maritime Comet. The first aerodynamic and propulsion prototype was rolled out from Hawker Siddeley's Chester factory during last month and will be followed in due course by the systems prototype.



First outing for the airframe and propulsion prototype of the HS.801 maritime aircraft

Besides being the first pure-jet maritime aircraft, which may be technical coincidence as much as intention, the HS.801 is certainly at least as advanced a maritime system as any other in the World. Elliott-Automation, and EFA in particular, are providing some of the central elements in the so-called "search, localisation and attack system".

### Only by Computer

The aircraft has to be advanced. It has to carry the most modern detection, tracking and attack equipment and, when a target is found, the operation of tracking or attacking must be effective. In addition, the detection and tracking systems produce far more information than crewmen with manual plotting aids or, for that matter, an integrated analogue system, can absorb in the time available. EFA's solution has been an airborne digital computer, rapidly processing incoming infor-

mation and presenting it in easily understood form to the crew. The situation can be very quickly assessed and the appropriate tactical decisions taken.

Each of the 38 HS.801s currently ordered will carry an MCS.920B computer designed into an airborne tactical control centre by Airborne Computing Division, with the co-operation of MDPD.

### As well as Computers

In addition, IND are contributing the E.3 inertial platform to provide attitude and inertial velocity information. FID are providing an advanced version of the modular air data computer and several flight instruments. Divisions outside EFA are providing the extensive and complex intercom and the mission recording system. Civil security

regulations make it very difficult to say as much about HS.801 as the U.S.A. has released concerning the Lockheed P-3C Orion with its ANEW system, which is due in service at about the same time as HS.801.

### Another Computer

Significant in ground support for the HS.801 is DADD's contribution of C700 automatic test installations controlled by MCS.920B computer. The C700 is second generation test equipment, far in advance of current tape-controlled analogue systems and destined to form the kind of installation which can test every item of equipment in large aircraft, civil or military.

HS.801 is a fine aircraft. EFA's contribution to it is of central importance.

### A Very Smooth Ride

Accurate bombing was achieved, said Lt. Cdr. Mears, with the aid of computed aiming commands viewed through the DADD head-up display. The MACD autopilot was used during the transit flights between Scotland and Wales, even though the journey involved only about 45 minutes at the normal cruising height. The Buccaneer S.2 has a good deal more thrust than the S.1, but its Rolls-Royce Spey engines are more economical. The resulting longer flight times give the EFA autopilot a positive function in reducing pilot fatigue—and pilots report that the system gives a very smooth ride.

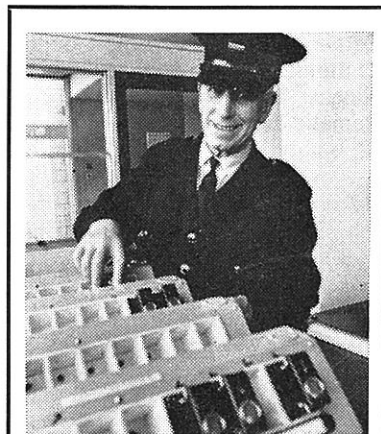
The Royal Navy has said that the Buccaneer is "the finest aircraft the Navy has ever had" and pilots temporarily attached from the USA and France, as well as others from the RAF are now flying them in Royal Navy squadrons. Typical of the long range of the S.2 was the 2,000 nautical mile non-stop flight from Goose Bay, Labrador, to Lossiemouth, Scotland, made in about 4 hr. 20 min. at the beginning of October 1965.

### Fast and Low

Many practice missions are flown low and fast at night over the sea, and attacks often call for penetration into hilly country. The Buccaneer autopilot is not called upon to cope with these extreme conditions, but EFA has plenty of experience of the problems involved. The TSR.2, fitted with an extremely advanced failure-surviving autopilot, would have flown very fast, very low in conditions in which the pilot could not have flown manually at all.

TACD is currently involved in another operation of this kind, namely, automatic landing, in which the pilot is not expected to take manual control, even after an equipment failure.

The critical factor, and one with which Buccaneer pilots are familiar, is the psychological one of trusting automatic controls in poor visibility close to the ground. Luckily, the Torrey Canyon operation was plain sailing as far as weather was concerned.



EFA security guard Mr. G. J. Richards checks some of the personal call "beeper boxes" at the entrance to the tower block. The factory-wide personal calling system is one of the responsibilities of the team of 10 telephone operators, whose activities are featured on Page 3

# WORKING ON POLARIS

## EFA's Unique Experience Pays Off

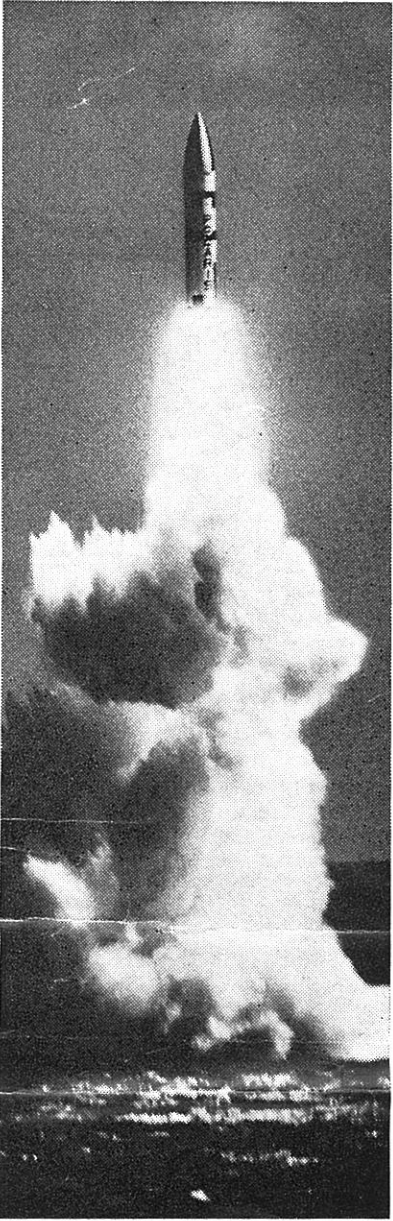
**W**E have often wondered quite what the EFA Polaris team has been up to—and never dared ask. Now Mr. Pallis, Polaris project leader in IND, has drawn aside the curtain to give EFA NEWS this exclusive, officially scrutinised and approved account of their activities. In advanced technology, one thing leads to another. It is in just such a situation as this that Elliott's combined expertise in system management and advanced techniques pays off—for the company and for the engineers themselves. Mr. Pallis reports:—

Training in USA was part of the jam that drew Elliott engineers to Polaris. One of the things that drew the MoD (Navy) to Elliotts for commissioning the Polaris submarines' navigation sub-system was this company's experience with inertial navigation. Alone among British or indeed European companies, Elliotts had designed and actually produced an IN system, for the Blue Steel stand-off bomb.

After exposing themselves to American techniques for a year or so, not without some satisfaction, our engineers returned home and went to work with Royal Navy Officers at the Ministry of Defence, filling-in details of plans for the tasks ahead.

### From School to Slipway

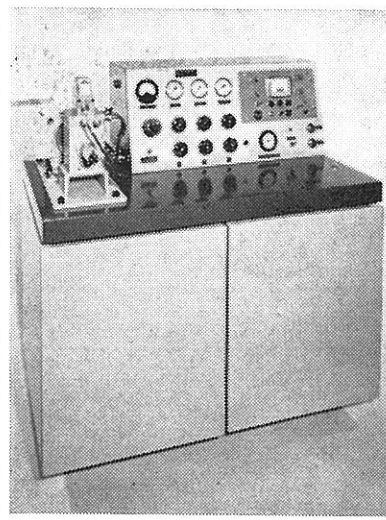
First task was the commissioning of the Royal Naval Polaris School near Glasgow, a weapon system on dry land for the training of the submarines' crews. Our employees accordingly migrated north in the summer and autumn of 1965. Many Government and private concerns played their part in the subsequent team effort, the culmination of which was the official opening of the R.N.P.S. on June 30, 1966, which was the original target date which was set three years before.



From the R.N.P.S. our team split for the next tasks into two main factions, which descended respectively on the shipyards of Vickers at Barrow and Cammell Lairds at Birkenhead. Each yard has since launched its first Polaris submarine; but as far as our engineers' work is concerned, it is only after the launch that things really get going.

### High-grade Men

Elliott computers and associated know-how are helping the MoD in the control of spare parts and of documentation covering the whole of this project. Yet another Polaris overall system contribution, which has been added to our original Navigation commitment and which should long out-last the other tasks, is in a performance analysis group. We have had high-grade men on Polaris from the outset, and they have all been gathering further useful experience from having to work in close co-ordination with many other contractors in a large project of proven capability.



MACD console for teaching electro-hydraulic servo techniques

**S**TUDENTS IN Belgrade, Yugoslavia, will soon be learning about electro-hydraulic servo systems with the aid of an educational console manufactured by MACD as a by-product of its electronic and hydraulic work.

The console contains an electro-hydraulic servo system arranged so that students can alter the characteristics of the system and clearly observe the results. The console is free-standing, mounted on castors and requires only an external electrical supply.

Basically the unit consists of a hydraulic power supply pack, a torque motor operated by the console electronics, a three-way spool valve and a four-way rotary actuator with a flywheel attached to its shaft. From these basic components and power amplification, an automatic error-actuated, closed-loop system can be produced. The system includes electrical, mechanical and hydraulic elements many of which can be adjusted

# Learning About Servo Systems

## Console Exported to Yugoslavia

in order to demonstrate the effects of each element on the system as a whole.

To demonstrate various conditions in a system the flywheel which is driven over an arc of  $\pm 30^\circ$  can be opposed by both viscous and coulomb devices. Equally, variable electrical feed-back in both positive and negative senses may be applied. Considerable thought was given to the convenience of the lecturer and students working at the console. The design was such that anyone seated would be at working level and, as shown in the photograph, clear desk space is provided for papers and books.

# PPC DOES WELL WITH RAF

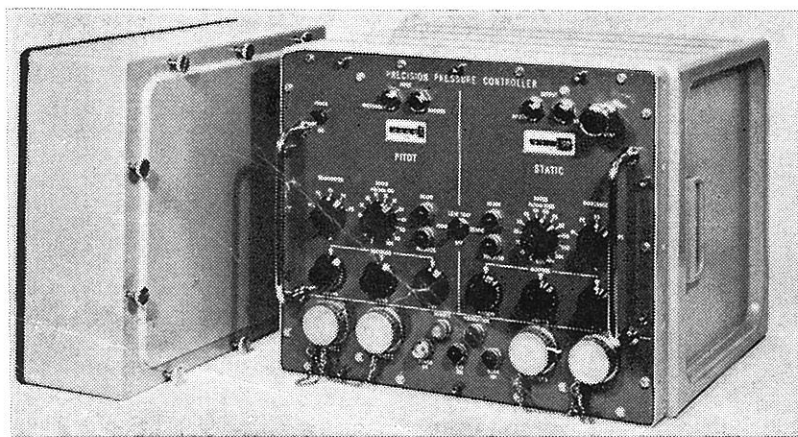
## Precision in All Weathers

**T**HE precision pressure controller prepared for the RAF last year has performed extremely well. DADD, whose product it is, report that the controller has been in constant use, summer and winter, by the RAF VC10 transport squadron and has frequently been used on a 24 hr, three-shift basis. On one occasion it was left out uncovered during a rainy night without ill-effects. The PPC is a high-precision reference instrument for barometric pressures,

used in flight instrument maintenance, but it is designed for the rougher world of the "flight line" rather than for sheltered laboratories.

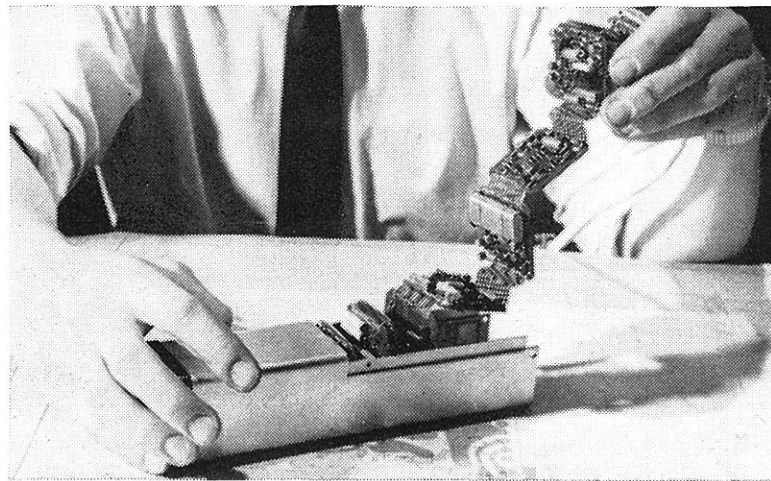
DADD report that it has proved "a tremendous time-saver" and that its technical success will be a major factor in new orders.

The RAF VC10s, incidentally, have substantially the same Elliott duplicate monitored autopilot, as the civil airliners. They could be fitted for automatic landing.



DADD's precision pressure controller: laboratory accuracy in a suitcase

# All in a two-inch case



**F**OLLOWING initial trials in the engine test beds at Bristol Siddeley's Patchway factory last Autumn, the first engine instruments for Concorde are now being delivered to Sud-Aviation at Toulouse. These instruments were developed by EFA on the basis of indicators designed for the TSR.2 and introduced into commercial aircraft laboratory standards of accuracy combined with a new small format. The instrument movement and the associated computer are both housed in a 2 in. square indicator only 5½ in. deep. The circuitry, including a high proportion of microcircuits, is mounted on boards with flexible strip interconnections.

Four types of instruments are being provided, l.p. r.p.m., h.p. r.p.m., T.4 and nozzle aperture, and all but the last-named will be duplicated in each aircraft, making 28 dials per aircraft. EFA has led the industry in produc-

The innards of one of the 2 in. engine instruments produced by AEID for Concorde

ing an r.p.m. indicator driven by pulse probe r.p.m. sensor rather than a tachogenerator.

Due to be delivered this summer are the first fuel flowmeters for Concorde, using the same combined indicator/computer layout, but associated with the Elliott true mass flowmeter transmitter. The system will measure flows of up to 15 tons per hour per engine, and it will also compute how much fuel has been used and how much remains. There will be four flowmeters per aircraft. The Elliott fuel flow laboratory has been used for development of these flowmeters. The laboratory is the most advanced of its kind in Europe. The true mass flowmeter has also been ordered for the Hawker P.1127 and for the British Phantoms.

## EFA people on the way up - appointments

S. A. ALLTIMES:  
to chief inspector TACD,  
{from test superintendent}

E. CONNOR:  
to production manager Gyro,  
from engineer Gyro

M. A. DORAN:  
to section leader draughtsman TACD,  
from checker draughtsman IND

B. P. FARADAY:  
to project leader DADD,  
from systems engineer IND

J. H. GAUSDEN:  
to EFA commercial executive,  
from controller MACD

D. G. HARRIS:  
to chief engineer IND,  
from (formerly) senior  
consultant Polaris project

R. W. "Bob" HOWARD:  
to cost and budget officer FID,  
from assistant  
EFA group accountant

D. R. HUNTER:  
to EFA personnel development  
manager, from personnel officer



## 48-LINE SWITCHBOARD MAKES WORLD-WIDE CONTACTS

### Rochester Exchange Team Uses Early Bird Satellite

**H**ANDLING a daily average of about 2,000 incoming and outgoing telephone calls is the vital job of the 10 ladies (see picture) who man the private manual branch exchange in the offices opposite the fuel flow laboratories. All 10 are GPO-trained operators with considerable experience, who have joined Elliotts to provide the voice link with the outside World so essential to our everyday work.

The 34 exchange lines and 14 dialling-out lines are manned from 8.30 to 5.30 every week-day and night lines are connected to selected extensions after hours. The team also operates the company tie-lines direct to other Elliott establishments at Portland Place, Borehamwood, Frimley and Lewisham. International calls are put through all over the World, some of them being relayed by the Early Bird communications satellite. Others are routed along thousands of miles of submarine cable.

### And 60 "Beepers" Too

Supervisor Mrs. E. M. Crumpler has 18 years' full-time GPO experience and joined the company in 1965. She reports that private exchange working offers more regular hours, without week-end and holiday working, although at rather lower salary than the more time-demanding GPO routine. Regular hours are important, because all but one of the team are married and have family commitments.

Also operated by the telephone team is the Telenova paging system, which can send a coded signal over a factory-wide induction loop network to any one of 60 "beepers" carried by senior staff and management. The 60 wearers are fortunate—or unfortunate—to be on call anywhere in the factory.

## Rifle Club Steadily Improves Performance

### EFA Fire-Power on Target

**M**ORE than 20 members of the Elliott (Rochester) Rifle Club shot in County and National leagues during last winter, and the A team worked its way up from Kent Division 9 during 1965 to Kent Division 3 last winter. Member John Kaighin (MACD) shot small bore for Kent reserves, and four other members have shot full bore for a Kent representative team.

The rifle club was founded in January 1964 by Les Prettyjohn, of Central Machine Shop, who is now its chairman. Original chairman was Reg Bloodworth (MACD). There were 20 members and the first four rifles were provided by Social Club funds. Membership now averages 60

at any one time and the 180th member joined recently.

Ranges and bookings have been a problem. One evening a week of .22 rifle shooting soon proved inadequate and the Boy Scouts' range at Buckmore Park was booked for Tuesday evenings. The original range was lost in the closure of Territorial Army Centres, but the RSME range at Brompton Barracks has now been secured for shooting on Thursday evenings and Saturday afternoons and evenings. Buckmore Park is available on Tuesday evenings.

Secretary of the Rifle Club is George Burbidge (MACD, internal telephone 330).

*Communications Centre for EFA is operated by the team of 10 ladies here shown at their switchboards. Seated, clockwise, are Mrs. Marjorie Allison, Mrs. Glenys Spittlehouse, Mrs. Pamela Webber, Mrs. Rosina Bainbridge, Mrs. Olive Ellen, Miss Margaret Brown, and Mrs. Brenda Smith. Standing, left to right, are Mrs. E. M. Crumpler, the supervisor, Mrs. Linda Poole and Mrs. Ann Macbeth*



*One of a list of successes by the Elliott (Rochester) Rifle Club was victory in Division 2 of the Maidstone Small-bore Rifle League. Above is the team. Standing, left to right, are M. Foreman (DADD), J. Kaighin (MACD), and team captain G. Burbidge (MACD). Seated, left to right, are D. Babington-Browne (TACD), Dawn Ward, described as team mascot, and H. Baker (AEID)*

## Business in Miniature

### Trade Fair by the "Under 21's"

**S**TEADY expansion has marked the four-year life of Young Enterprise, which started in Chatham and now has branches in many other parts of the country. The scheme is to introduce young people to the techniques and procedures of the business world by forming small trading companies with the support

*Backing Young Enterprise during its week-long trade fair in Chatham were, right to left, Mr. Pateman, Deputy Chairman and Joint Managing Director of EFA, Joan Johnson, chairman of the Students' Committee, Lord Beeching, president of Young Enterprise, Lady Beeching and Mrs. Pateman*

and advice of local commercial companies.

A week-long trade fair was held in Chatham to exhibit the products of several of the local Young Enterprise companies, and one of these, Royell, is supported by Elliotts. The name is a combination of Rochester, Young Enterprise and Elliott. EFA

advisers, who have given their free time and assistance, are Norman Evans (IND), John Roach (Fisher), John Goodhand (MACD) and Dennis Nightingale (Fisher).

Royell was one of 10 companies at the trade fair and did good business selling pen stands decorated with pictures of vintage cars.

EFA management has given full support and Mr. Pateman and Mr. Alexander both visited the fair. There with them was Lord Beeching, who is Young Enterprise's president.



## IS IT TRUE

That Cdr. Fenn-Clark is tipped to win the EFA paper-chase.

★

That the divisional buyer who broke new ground by buying his own lunchtime beer, can't afford to do it any more. He is paying off a motoring fine.

★

That a certain production manager was sea-sick on the Gravesend to Tilbury ferry.

★

That heavy management pressure failed to censor the diet sheet in the last EFA NEWS.

### LETTER TO THE EDITOR

Dear Sir,

My attention has been drawn to your General Knowledge Section—"Is it True?". Before publishing information for the edification of your readers, I feel you should check your facts. I do not think the speed limit is 110 m.p.h.: in fact, without further tuning, it is 105.

Yours faithfully,

ANON

P.S. I am sure the other nine items are entirely accurate.

## Feline Friendship Links EFA And Fisher

### Offspring Wins Cat Show Prize

At lunchtime every day Mr. G. W. Stubbs, inspector in the Central Machine Shop viewing room, walks across to the Fisher Governor casting store to feed a cat which was discovered there a few years ago and has lived there ever since.

During the years, the cat has produced three litters, and Mr. Stubbs has found homes for all the kittens. He gave a tortoise-shell kitten from the last litter to a Fisher Governor employee who subsequently entered it for a local cat show. And the kitten won a prize.

The cat regards Mr. Stubbs as its owner and protector. When Mr. Stubbs retires sometime later this year, he will not forget the cat. He plans to take it home to live with the Siamese he already has there.

So the saga of the productive stray cat will have a happy ending—and Central Machine Shop claims that the story is another example of the "firm producing the goods".

# THE GREATEST AIR SHOW ON EARTH

## 20 Years in Automation

ONCE again the Paris air show is bringing the aviation and space giants from East, West and centre to battle for prestige at Le Bourget airfield. From May 26 to June 4 technicians, customers and public are gathering by the hundred thousand, if only because they cannot afford not to be there—and because only at the Paris Show can you see World aviation in one place.

Elliott-Automation's effort this year is only slightly smaller than it was in 1965, though the group will have two brand new systems on public view for the first time—an airborne radar, and a new navigation system. Also on the Elliott stand will be C-5A and Concorde equipment, a head-up display and the new attitude control for the Skylark sounding rocket. French agent Europe Air Service will be exhibiting Elliott instruments.

### EFA in World Lead

Ministry of Technology is showing Elliott automatic landing equipment as part of a special exhibit. In the British industry pavilion, Elliott's part in giving Britain a World lead in automatic landing will be prominent. To man the stand from 9.00 a.m. until 8.00 or 9.00 p.m. throughout the 10 day show, a team of eight EFA men working in shifts alongside others from ESVAL and EARS, have to cope with anything from bands of pint-sized brochure hunters to visiting potentates. High physical fitness and mental alertness are essential. Paris in late Spring can be biting cold and muddy up to the ankles or boiling hot and dusty. Either condition can make life difficult.

### Historic Sidelight

An unusual EFA contribution to Paris should be the Sopwith Pup, specially flown to Paris by "Doc" Stuart, TACD sales manager. He is one of the very few pilots approved by the Shuttleworth Trust, the Pup's owner; and he may fly the Pup during the display. The Pup may be parked beside Beagle's brand-new Pup club trainer, the two types being just about 50 years apart in design. A little known fact is that Elliotts made thousands of flight instruments during World War 1. The Pup was one of the many types so equipped. At last year's Farnborough show, the newly rebuilt Vickers Gun Bus was fitted with remanufactured Elliott flight instruments and with an incli-

nometer tube actually preserved from a World War 1 aircraft. The tube had spent the intervening years as a paperweight.

The mighty United States participation at Paris is being keyed to Lindbergh's solo New York to Paris non-stop flight in 1927, just 40 years ago. A replica of Lindbergh's aircraft, Spirit of St. Louis, is suspended in the entrance archway to the US pavilion. It is being flown across the Atlantic in a Lockheed C-141 jet transport, which may try to set up a new record on the way.

What the Russians decide to show is anyone's guess, and usually the subject of wild rumours until the very last moment. This year, everyone wondered whether they will bring their supersonic transport prototype—if it is indeed yet flying. A very large manned space vehicle might conceivably be there too.



Paris Le Bourget at show time—where the giants compete for prestige—is going to be even more crowded this year than it was when this "Flight International" air-to-ground photograph was taken at the show in 1965

## Computer Flies Again

### Test Results Printed Before Landing

FLIGHT testing of new navigation equipment in a Comet 4 of the A&AEE at Boscombe Down is being greatly speeded-up by use of an MCS 920 digital computer mounted on a special pallet and carried in the aircraft. The installation was produced by ACD, the only EFA division at Borehamwood.

The computer was first used for similar flight trials early in 1965, when it replaced the original computers of the TSR.2 navigation system and was used both for navigation and test recording. The results of those trials demonstrated the usefulness of a computer in producing quick records, on one occasion while the aircraft was still airborne. The fact that the 920 could be rapidly reprogrammed for successive tests also minimised delays between flights.

In the current trials, the 920 is running a navigation programme for an inertial system in parallel with the system's own computer, and it is also calculating independent position fixes from Decca, Loran and Doppler outputs. Every five minutes it prints out its own position fix and that produced by the inertial system, to indicate quickly that the equipment under test is still functioning correctly. This ensures that no flight time is wasted.

Initial test results in printed form can be produced in the air while the aircraft is preparing to land. Considerable data reduction time is saved in this way. The trials are to continue during next month.

Another application of the 920 to flight test data reduction is now being prepared.

## A LOOK AT GOOD LOOKS Equipment Design Displayed

THE appearance and functional layout on control panels, instruments and even "black boxes" can have a powerful influence on potential customers and users of our products. In fact, the crackle-finished black box is now superseded by handsome "grey boxes" with smart handles, dials and self-test switches.

Peter Bell, a design consultant retained by EFA, E-A Computers and other companies, has advised on the design of such items as the Concorde autopilot controller, the head-up display and the educational console described on page 2.

He and his colleagues Peter Ralph and Paul Hepworth will be on hand in conference room 4 on June 12 and 13 at a special exhibition of design. The exhibition will be open from 10 a.m. to 5 p.m. and will include many models, photographs, drawings and actual equipment, including the special controls and keyboards of the Elliott Field Artillery Computer Equipment (FACE) recently ordered in quantity by the Army. Why not spare a few minutes?

## VISITORS AT ROCHESTER



◀ From the U.S.A. Examining a head-up display in DADD, are Mr. Robert J. Doran, deputy director of Navigation & Guidance Division of the U.S.A.F. Avionics Laboratory (left) and Mr. P. L. Pryor, senior scientist of the Laboratory's Reconnaissance Division (stooping). With them are, left, Ron Lowry, DADD sales, and Ken Warren, EFA Marketing Manager. The Americans came from Wright Patterson AFB, Ohio

From Japan ▶ Mr. T. Takahashi, president of the Nippon Miniature Bearing Company (left) and Mr. T. Egawa, manager of their London office. Talking to them are Fred Haskett, deputy marketing manager (left centre) and Mr. P. A. Jassoy of E-A (Overseas) Ltd

