



THE AERONAUTICAL JOURNAL

JUNE 1970

NOTICES

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THE MRCA PROJECT

B. O. Heath

ECONOMICS OF PROPULSION SYSTEMS FOR AIR TRANSPORT

Sir David Huddie

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PROBLEM

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THE EXTERNAL AERODYNAMICS OF HOVERCRAFT

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THE EDWARDS REPORT AND CIVIL AVIATION IN THE 1970s

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On the Tailoring Conditions in a Combustion Driven Shock Tube

P. G. Simpkins

A Non-Linear Solution to a Tab-Aileron Flutter Problem

D. L. Birdsall

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SUPPLEMENTARY PAPERS

CUMULATIVE DAMAGE PROBLEMS IN AIRCRAFT STRUCTURES AND
MATERIALS

J. Schijve

THE ROYAL AERONAUTICAL SOCIETY

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3D

3 DECCA for 3-Dimensional Air Traffic Control

The concept of Area Navigation – the capability to navigate precisely along any track, over any series of reporting points, to provide complete route flexibility and enhanced capacity within an ATC System – has long been a cornerstone of Decca Navigator philosophy.



Decca – who pioneered Area Navigation – are again first in the field of 3-Dimensional Guidance. By additional programming in the Omnitrac airborne computer, any way-point or reporting point can be defined as a specific point in space, at altitude, instead of simply as a geographical location on the surface. By computer calculation, based on the required height

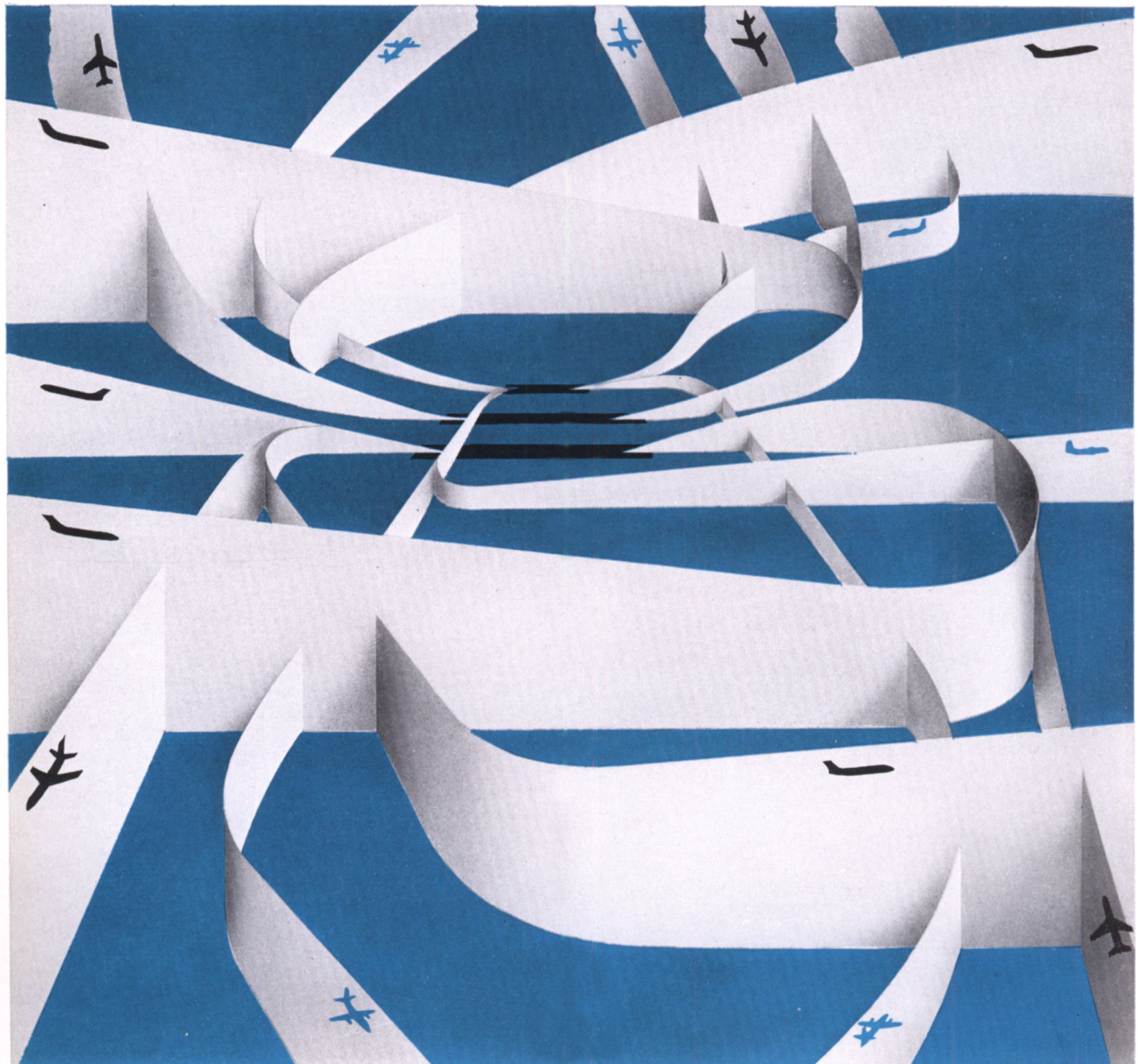
difference between successive points, command information is displayed to enable the required profile to be flown along the chosen flight path.

The 3-D feature is applicable ● for Standard Instrument Departure and noise abatement routes ● in the climb phase ● in the cruise or step-climb phase ● for optimum descent profiles ● for instrument approach procedures

By virtue of these techniques, an Air Traffic Control clearance can be issued, specifying required route and profile, in the knowledge that the pilot has the capability to maintain such clearances.

The new generation of aircraft, SST, Jumbo and Airbus, V/STOL, will demand maximum utilisation of available airspace. V/STOL City-centre operations will demand discrete routes and altitudes on a mutually non-interfering basis with Conventional aircraft. 3-Dimensional Guidance is a pre-requisite in the total Air Traffic System – as Eastern Airlines have recognised in their STOL Evaluation. Efficient Navigation means Efficient ATC and Efficient ATC means 3-D NAV.

 Conventional tracks
 STOL tracks



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JUNE 1970

The peace keepers of the seventies

The Royal Air Force enters the new decade with three of the world's most advanced military aircraft, designed and built by Hawker Siddeley.

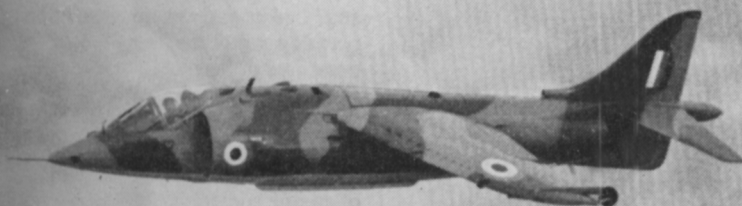
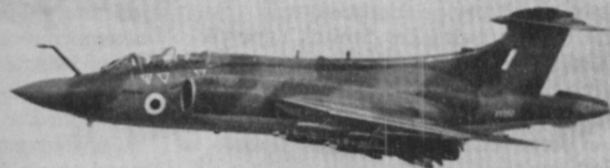
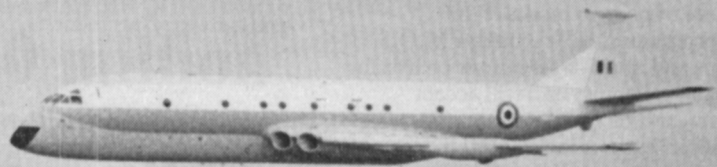
The Nimrod, maritime reconnaissance and anti-submarine aircraft. The first four engined pure jet to perform this role.

The Buccaneer, specifically designed for high-speed, low-level strike and reconnaissance.

The Harrier, the world's first Vertical/Short Take-Off and Landing (V/STOL) tactical close support fighter.

Two of the world's most sophisticated missiles, Martel (television guided) and Red Top (infra-red guided), also demonstrate Hawker Siddeley's leadership in advanced technology.

A team that provides a powerful and effective force for peace.



 **Hawker Siddeley—the largest aerospace group in Europe**

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Hawker Siddeley Group supplies mechanical, electrical and aerospace equipment with world-wide sales and service.

Electronic displays from Smiths Industries

The new technique of electronic head-down display is well advanced at Smiths Industries

The unretouched photo taken on long exposure shows a $5\frac{1}{2}$ " c.r.t. display of engine pressure ratio and emphasises the clarity and stability of the symbology. Virtually any type of information can be presented on this type of head-down display on a sequential or selective basis.

The head-down unit receives information from the new Smiths digital waveform generator, which represents a major advance in symbol generation for electronic displays.

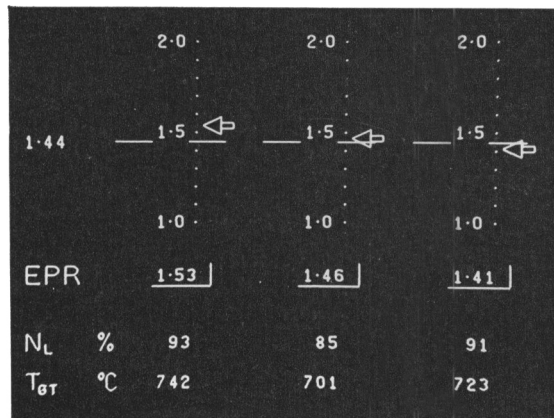
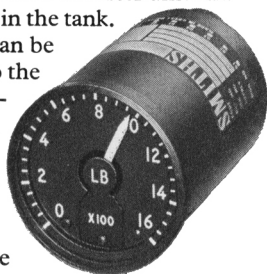
Small, light and entirely new in concept, this generator greatly increases the flexibility of the display system by use of plug-in modules for re-programming. It employs M.O.S. chips and multi-layer circuit boards for greater reliability and will accept digital and/or analogue input signals—other features include failure monitor capability, press-to-test facility and a predicted MTBF in excess of 1000 hours.

Head-up

Smiths Industries advanced head-up display systems have been specified for the Harrier and Jaguar aircraft—development is also taking place on a head-up system for civil applications.

28V Capacitance Fuel Gauge

The Type 7 Capacitance Fuel Gauge has been specifically designed by Smiths Industries for feeder-liner, executive and light aircraft requiring a simple and inexpensive fuel measurement system. Operating directly from a 28 V dc supply, Type 7 is accurate, uncomplex and compact. Basically it consists of a 2 inch indicator, a small converter unit and a probe or probes in the tank. The installation can be tailored exactly to the needs of the particular application. Typical accuracy figures for a basic system in normal temperature and fuel conditions are $\pm 1.15\%$ tank empty to $\pm 1.30\%$ tank full.



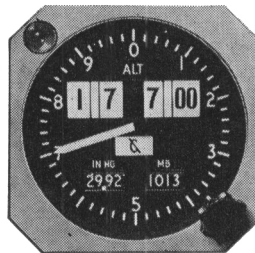
Compensation for variations in fuel permittivity is easily incorporated by the addition of an immersed capacitance reference unit.

While primarily designed for aircraft fuels, Type 7 can also be applied to oil contents measurement.

Altitude alerting meets FAA mandatory requirements

By March 1971 a sequence of audio/visual signals to warn pilots of approach to a selected flight level will be a mandatory FAA requirement for U.S. civil airliners. Smiths Type 3B Self-Sensing Servo Altimeter with an Altitude Alerting Unit is the simple answer.

An output of indicated height (baroset corrected) from the type 3B is fed to the Altitude Alerting Unit to produce any sequence of audio/visual warnings. The system also signals departure from the selected flight level. The altimeter has a contact type digitiser for automatic height reporting, an integral servo amplifier and a full five-figure height readout. A servo repeater version is also available.



The Altitude Alert Unit, in a $\frac{1}{2}$ -3ATI case, has integral lighting with front replaceable lamps, automatic reset, press-to-test facility and an accuracy better than 50ft. at all warning levels.

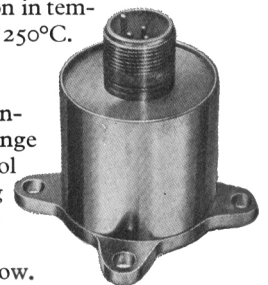
Engine health—taking the pulse

Accurate detection of shaft-speeds, gas temperatures and oil, fuel and air pressures is vital for monitoring the health and performance of aircraft gas turbines. On the RR Olympus 593 in the Concorde, for example, Smiths Industries supplies no less than 18 units per engine for sensing these vital parameters.

For speed measurement Smiths Tachometer Generators employ advanced materials technology to achieve maximum performance and long life. And we have a range of small magnetic pulse speed probes for severe environments or where multi-signal outputs are required.

Smiths thermocouples have been specially developed to provide maximum protection to the bi-metal junction without impairing its response to temperature changes in the gas stream. Single thermocouple probes or complete high-strength harnesses can be supplied.

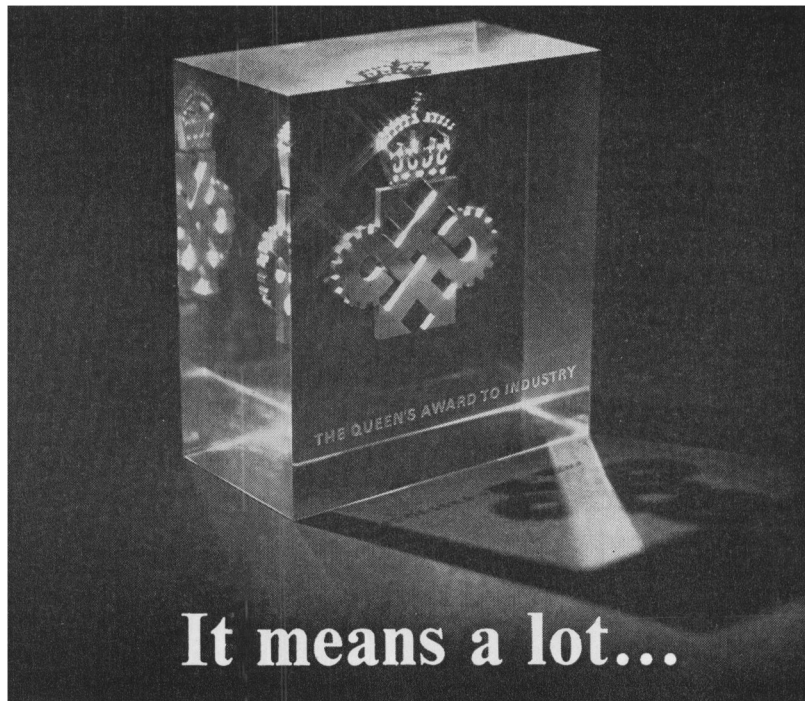
Constant modulus alloy steels and argon-arc welded construction are the main features of the capsules in Smiths Pressure Switches and Transmitters and they can withstand an overload of up to ten times the working pressure. Stainless steel bodies and ceramic insulation permit operation in temperatures up to 250°C. Full details of these high performance sensors, and our range of engine control and monitoring equipment, are available from the address below.



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When a customer buys a British Aircraft Corporation product, he knows that with it he gets the services of the most professional support teams in Europe – some customers have even been kind enough to say "in the world."

It has taken decades of experience and investment for the companies of British Aircraft Corporation to build up this position for Britain. That is why today – in commercial and military aircraft, in defence systems and weapons, and in application and research satellites – British Aircraft Corporation is the most powerful aerospace company in Europe and the most respected European aerospace company in the world.



BRITISH AIRCRAFT CORPORATION
the most powerful aerospace company in Europe

100 PALL MALL LONDON SW1

*Sqn. Ldr. A. L. Fraser, C Eng.,
M1 Mech.E, RAF, interviewed
with his family in Germany*



“You are an RAF engineer. Do you like working abroad?”

Yes, I do. Moving around, as one does in the RAF, keeps you from getting into a rut. We shall probably be here for about 2½ years, and we want to see all we can of Europe. We’ve just bought a new car, and we’re thinking of buying a caravan. If you are interested in touring holidays, and in seeing new places, this may be where you start getting slightly envious!

What is your job here?

Engineer Officer of one of the Lightning Squadrons assigned to Nato. This is a Squadron with a real sharp-end job to do—we have aircraft at readiness 24 hours of the day. My function is to keep the aircraft serviceable.

What does this involve?

All the servicing and rectification normally done on an airfield. I have 140 men—among them some of the most highly skilled aircraft technicians you can find anywhere. But the main requirement, for any officer in a job like this, is to have a flexible mind.

From outside the RAF this might seem surprising!

I know. There are people who think that, because the RAF is large and highly organised, you always work from the book. This is nonsense. With an aircraft as complex as the Lightning, decisions call for careful judgement (this is what engineers are for). You mustn’t be thrown by the unexpected! And you mustn’t depend too much on routine: for instance, I’ve just come back from Belgium—we had six aircraft there on a visit: and it’s a regular part of life to operate from other countries’ airfields.

Have you always worked with fighter aircraft?

No indeed. For the best part of seven years, before I came here, I worked much more with civilians. I was a Project Officer at Farnborough. I did some development and trials work on a new bomb tail, then I worked on another weapons project—right from the original conception, through the design and test rig stage until the beginning of air trials. The rest of the time was at the Ministry of Technology: this was a staff appointment, concerned with developments and modifications to the Lightning; at a desk most of the time, but I went to the factory about once a month, for meetings with the designers. It was interesting, being in at the birth of new ideas.

You’ve seen both sides of the job: civilian and RAF.

How do you think they compare?

A lot of civilian engineers work in a narrow

field. Personally, I’d hate to be side-tracked into one speciality. The RAF gives you the chance to vary your job. I think that’s a big factor.



The aerocrat offer to engineers

If you are under 39, and hold a Degree or professional qualification in an engineering or scientific subject (minimum qualification for some appointments, HNC in mechanical or electrical engineering) many different appointments could be open to you. *Minimum is 3 years; maximum, a ‘full career’.*

Interested?

This coupon will bring you full details.

To Group Captain E. Batchelar, RAF, Adastral House (101 RY1), London, W.C.1.
Please send me without obligation information about careers for engineers as officers in the Royal Air Force.

Name.....

Address.....

Please attach a separate note giving, in confidence, your date of birth and details of your qualifications and experience.

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