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JANUARY 1989
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1987

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JANUARY 1989

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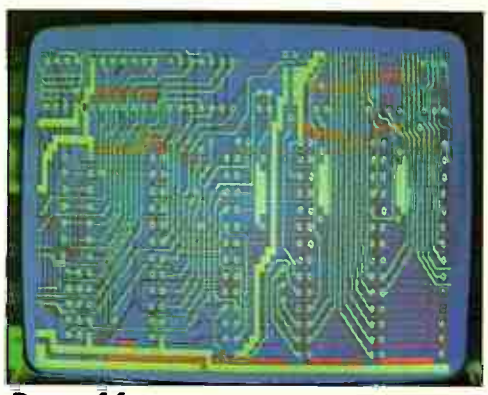
DEPARTMENTS



Page 44

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ARIUM CORPORATION

Arium does it again!

READER INFO No. 2

JON FAIRALL

Ultraviolet blues

Welcome to the third ETI yearbook, a compendium, we hope, of stimulating reading to wile away the hours spent loafing on the beach getting over-exposed to ultraviolet radiation. It's a matter that has some relevance to our 'Comment' and 'Politics' sections this month.

Normally, I like to reserve 'Comment' for a discussion on some local issue affecting science and technology, but this month it's devoted to a speech by British Prime Minister Margaret Thatcher, if only because the speech, to the Royal Society in London, has been widely ignored by the mainstream media. It ought not to have been.

Thatcher has a well-deserved reputation for never changing her mind. The lady, it is said, is not for turning. She came to power in Britain long ago, a disciple of Friedmanite economics, and it appeared that one day she would leave office just as wedded to it. On the way, many a venerable British institution, as well as many a bold British innovation, have disappeared for ever, slaughtered by market forces. Science in particular has been decimated in Britain. Australian researchers may well bemoan their lot, but our own PM, Bob Hawke, has much to learn from Mrs Thatcher when it comes to parsimony.

And yet now the lady has turned. And the cause? Thatcher, it seems, has turned green. The reality of global warming, once the province of maverick scientists on the outer fringes, has at last penetrated to the centre of British society. Heresy has become motherhood.

'. . . the reality of atmospheric pollution'

It is too early to say whether one should be overly cynical. The Greenhouse Effect is a global phenomenon, and it can only be attacked at a global level. It is not succeptible to attack at an individual level or even at a state level. Not even the most ardent Friedmanite can argue that this is a problem that will simply go away as soon as the 'dead hand' of state intervention is lifted. To her credit, Mrs Thatcher seems to understand that, and be ready to abandon her free market zeal, at least on this front.

It remains to be seen whether Mrs Thatcher's actions match her rhetoric. British scientists, in every discipline from Archaeology to Zoology, are looking for research funds to study some implication of The Greenhouse Effect, so we will soon know where the bottom line lies.

Meanwhile, it is good to note that Senator John Coulter (See p 34) has introduced the Commonwealth Parliament to the reality of the atmospheric pollution in this country. We have little reason for complacency.

Finally, ETI has the distinction of being the only magazine in the country to survive 1988 without mentioning the Bicentenary. 1989 having arrived, we can now breathe out again and you will notice a photo essay by photographer Peter Beattie who spent a day at the Bicentennial Air Show at RAAF Richmond. It was a great show, and a great day, and evidently some great business was written.

Have a nice 1989.

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Industry News

One of the Australia's few locally owned approved defence contractors has attracted AMP as a 15 per cent shareholder and two top-flight directors to its board.

Stanilite Pacific Limited of Lidcombe (Sydney) is now established as a supplier to the Defence Department.

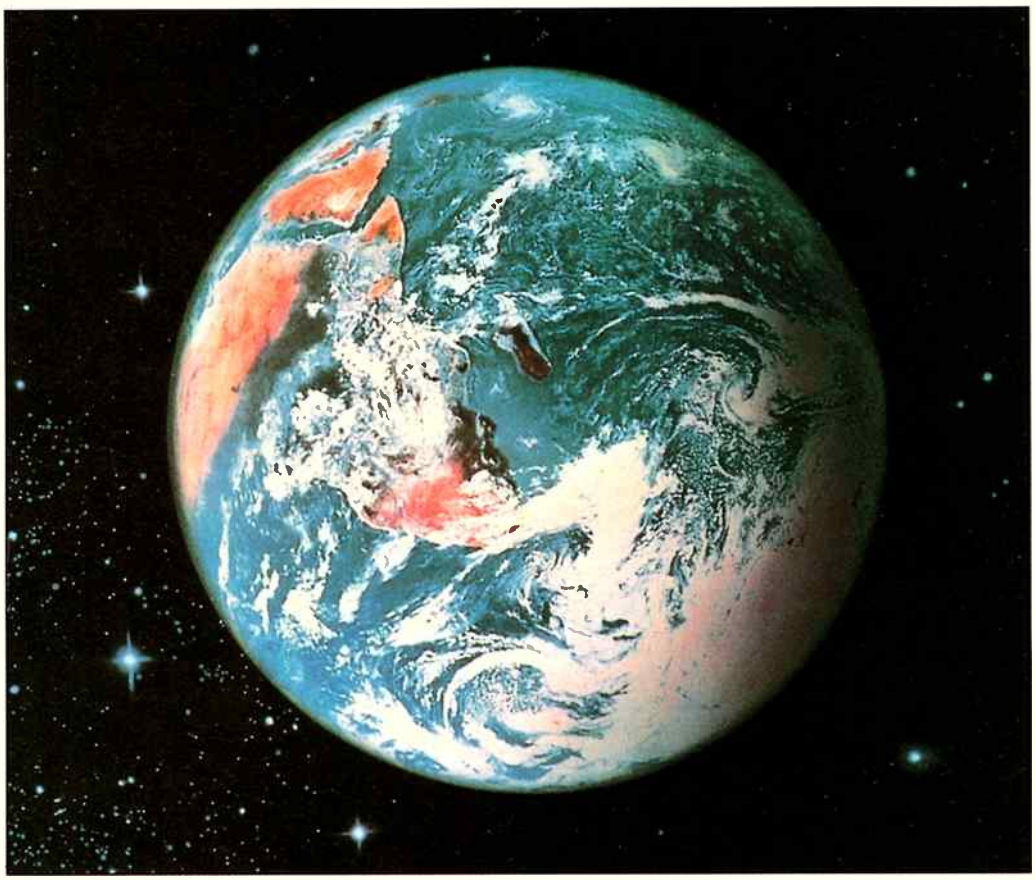
As well as receiving the new subscription of capital from AMP, Stanilite has appointed to its Board, John Curtis, formerly a Director of Wormald and President of Wormald Ausul (London) and currently Chairman EFTEL Limited, and Reg Humphreys formerly CEO of Partnership Pacific.

★ ★ ★

Tony Lee.

David Bierwirth has been appointed Datacraft's national dealer manager, based at the Croydon head office.

John Brownlow has been appointed national LAN manager, taking over at head office from Tony Lee, who has been appointed dealer LAN sales consultant for Victoria and the ACT while Alistair Mackie has been appointed southern regional sales manager, responsible for Victoria, South Australia and Tasmania.



Ozone hole weaker

Scientists at the NASA Goddard Space Flight Centre, Greenbelt, Maryland in the US have noted the emergence of an unusually weak Antarctic ozone hole in 1988.

The scientists have been closely monitoring the total ozone levels over the Southern Hemisphere with the Total Ozone Mapping Spectrometer (TOMS), an instrument on board the NASA Nimbus 7 satellite.

In 1987, the minimum value of the ozone over Antarctica decreased by nearly 50% during September. If ozone amounts remained approximately constant throughout October in 1988, as has occurred in previous years, then the ozone hole will be its smallest since 1982. Data later than September 1988 has not yet been analysed.

Goddard scientists Arlin Kreuger, Richard Stolarski and Mark Schoeberl reported that the winter began with record low ozone amounts at mid and sub polar latitudes. In August, the polar vortex became highly distorted by large scale waves. Kreuger, the TOMS principal investigator says the ozone hole in September was considerably offset from the south pole and was weak compared to the 1987 hole.

Current theories of the ozone hole require that the polar air remain contained in the band of strong stratospheric winds that surround the Antarctic throughout September.

However, it appears that 1988 was a year of unusual dynamic activity in Antarctica. This has both reduced the amount of ozone depletion within the whole, but also over the whole of the Southern Hemisphere. The reason for the activity is not fully understood.

Nimbus 7 TOMS data is being processed in near real time at Goddard and transfered to scientists around the world.

Work skills

Five apprentices from the Hunter Region (NSW) participated in the consumer electronics section of the Work Skills Australia competition. The competition was conducted at the Newcastle Showgrounds in October.

Work Skills Australia began in 1982. Since then, more than 8000 young Australians have competed in over 40 categories. The winners compete in the national finals before a lucky few gain the opportunity to compete in the Work Skills Olympics.

The consumer electronics participants are students currently attending the electronics trades course conducted at Newcastle Technical College.

David Leask gained first place in the competition. A presentation was held at the Hunter Institute for Higher Learning on completion of the competition.

Tim Cooper, employed by Video and Visuol of Erino NSW, nears completion of a burglar alarm project for the Work Skills Australia competition. On completion, a number of specified tests, including fault finding, hod to be performed.

Management contract

OTC has one of the world's largest space communications management contracts.

The contract involves the management of International Telecommunications Satellite Organisation (INTELSAT) satellites over the Indian and Pacific Oceans for up to 10 years.

The contract was awarded for the Tracking, Telemetry, Command and Monitoring (TTC&M) of INTELSAT satellites over the Indian and Pacific Ocean regions, for a period of five years from the beginning of 1991.

Industry News

Dovid Horvey.

David Harvey has been appointed a senior consultant with Cooper Associates, a Sydney-based public relations consultancy, with responsibility for services to clients in advanced technology industries.

Mr Harvey has more than 20 years' experience in journalism and promotions. His early years were spent as a news reporter in Hong Kong, and this includes two years as a war correspondent assigned to South Vietnam.

★ ★ ★

VLSI Technology, reported revenues of $53,683,000 for the second quarter of 1988, up 28 per cent from the corresponding quarter a year ago. VLSI realised net income for the quarter of $2,974,000, or $1.13 per share, as compored to net income of $1,693,000, or $.07 per share, during last year's second quarter.

Alfred J. Stein, Chairman and Chief Executive Officer, stated: "We are pleased to report these results for this period, especially after a difficult first quarter.

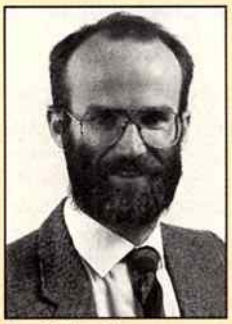
Industry News

Csironet has announced a net operating profit after tax of $440,000 for its first six months operation as a fully commercial company.

The profit was made on a revenue of $7.734m and gives an earning per sharer of 7.9 cents.

Csironet, formerly the independent computing agency of CSIRO, was commercialised on October 1, 1987, as a public unlisted company.

★ ★ ★



Geoff Smith.

Austek Microsystems has announced two new appointments at its Adelaide head office.

Mr Geoff Smith has been promoted from Manager to vice president, VLSI engineering, with worldwide responsibilities for activities in this area.

Mr David Johnstone has joined Austek in the newly created position of engineering Manager, advanced development.

★ ★ ★

Amber Technology has moved its Melbourne office to new and larger premises on 200 Rouse Street, Port Melbourne.

Amber's Melbourne office is headed by Lance Beal as General Manager. Enquiries ☎ (03) 646-5811.

AT spinoffs

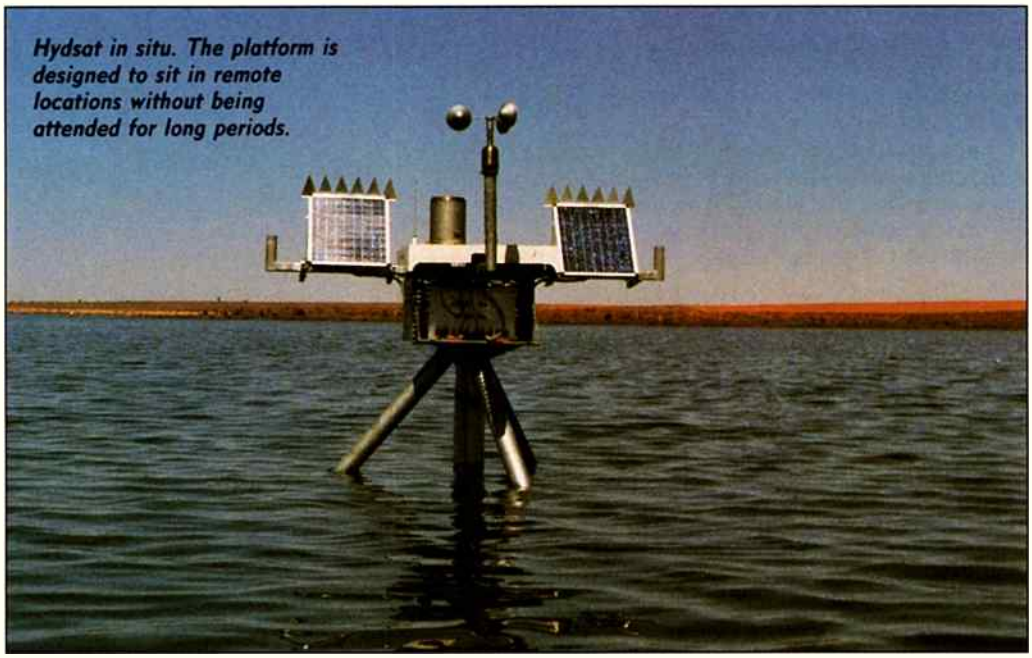
It is less than six months since the Australia Telescope was opened, and already commercial spinoffs of the enterprise are coming to fruition.

Austek, in conjunction with the CSIRO, has developed a product that has its foundations in the AT correlator. Called the A41102 frequency domain processor (FDP), Austek launched the product in November. According to Austek, it is the first chip of its type in the world.

It is intended as the first of a family of DSP chips that will be released in the comming months. The primary market is expected to be the US, and Austek is forecasting that this market will be worth US$100 m over the next five years.

DSP, or Digital Signal Processing chips are expected to have very large ramifications in communications, music and videa technology during the next decade. Their ability to take an analogue waveform and transform it into the digital domain is expected to become invaluable. Current world leaders in the field are Texas Instruments with several products in the area. However, the technology is developing rapidly.

Austek, based in Adelaide, was set up by refugees from the CSIRO who had developed significant expertise in Multi Program Chip technology. Since then, the company has become the leading Australian micro electronics house. Recently, however, their lead has been challenged by AWAM, the Sydney based microelectronics subsidiary of AWA.



Hydsat in situ. The platform is designed to sit in remote locations without being attended for long periods.

Remote logging

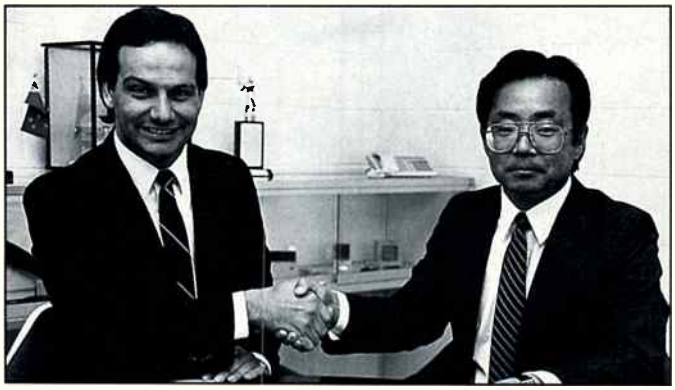
The CSIRO has designed a low cost, solar pawered, satellite communicating, data collection platform for remote sensing applications called Hydsat.

Developed by a technical team within the CSIRO Water Resources Division, the platform is designed to play host to a large range of sensors in a wide range of environments. CSIRO publicity suggests things like tidal and river guaging, monitoring ground water levels, solar radiation flux, barometric pressure and wind measurements and so on.

A data recording mechanism is provided. It will allow control of the instrumentation on board, managing logging and sensors, as well as recording the results. Data storage can be either in solid state devices or on magnetic tape.

Hydsat is of particular interest because of a world wide shift to remote monitoring of all kinds of environmental parameters. It is cheaper to put a sensing platform in a remote location, and buy satellite time to access it, than to send a man into the field to make the measurement. See, for instance, the article on Sea Level Changes (ETI December 1988).

OEM distributor



Michael Crismale and Kosaku Arahata.

Omron Electronics has selected ACD Elektron, an operating division of Advanced Component Distributors, as the distributor for its OEM (Original Equipment Manufacturer) products division.

Mr Kosaku Arahata, Managing Director of Omron Electronics which is responsible for 'Oceania' (Australia, New Zealand and Papua New Guinea) said Omron Electronics was about to enter a new phase of growth.

The Managing Director of University Paton, Mr Michael Crismale commented ACD Elektron was recently established to operate in a specialised segment of the electronic component distribution industry, which naturally encompasses the Omron OEM product range.

Infra Red gets the nod

The Broken Hill Proprietary (BHP) has joined with the Adelaide Innovation Centre and the Surveillance Research Laboratory to invest in a small Adelaide company called Cemek, which claims to be a world leader in molecular beam epitaxy (MBE).

Cemek has been set up to develop an infra red camera using MBE techniques. The venture has been awarded a grant of $2.84m from the GRID scheme.

Epitaxy refers to the process of placing atoms in an orderly arrangement upon a crystalline substrate. Thus, the film of atoms created will follow the atomic arrangement of the substrate. In MBE, the film is deposited by heating the film material in a vacuum. As it is heated, atoms of the material will fly off, coating any nearby object. By carefully controlling temperature and pressure, it is possible to get a predictable, repeatable uniform layer that might be only a few hundred atoms thick.

There is nothing particularly novel about this process. However, Cemek have come up with a new approach to the problem.

"The accepted process depends on trying to make all the control parameters as steady, or as uniform, as possible, in the hope that this will lead to uniform films," says the research director Richard Hartley. There is no feedback during the process.

Hartley and his team are developing what they call a closed loop method. He wants to monitor the uniformity of the crystal during growth so that he can decide what action should be taken to keep it uniform as it grows. To this end he has developed two tools: a probe which is able to measure the composition of the material with great accuracy, and an ion beam system that will force the composition to grow at a predetemined rate.

Hartley is experimenting with an alloy of Cadmium, Mercury and Telluride (CMT) which can be used as an infra red detector. The present generation of CMT, however, can't be used to make a practical camera because of uniformity problems. If you want an infrared camera it has to be a large clumsy mechanical device. The closed loop system MBE should be able to make the CMT so uniform that it can function as an image detector in an infrared camera.

A fully electronic infrared camera would have many applications, not least being: remote sensing for minerals from orbit; search and rescue from aircraft and medicine.

Meanwhile, AT&T, the American communications giant has been working on the same problem, and come up with a different system. AT&T have replaced the CMT with Gallium Arsenide (GaAs), but they also used MBE to lay down quantum wells in the GaAs.

AT&T researcher Clyde Bethea.

Industry News

Jim Barnes.

Zenith Data Systems has appointed Jim Barnes as dealer development and support specialist.

Mr Barnes, who has 15 years experience in the computer industry was dealer support manager for AWA microcomputers before spending the past two years as an independent consultant advising on PC-based small business systems.

★ ★ ★

Mach Systems, a Melbourne-based dedicated jobbing facility that provide dedicated electronic board loading, drafting and engineering, are refining their manufacturing techniques.

Managing director Cam Johnson stated that demand justified an aquasition of new state of the art production requipment.

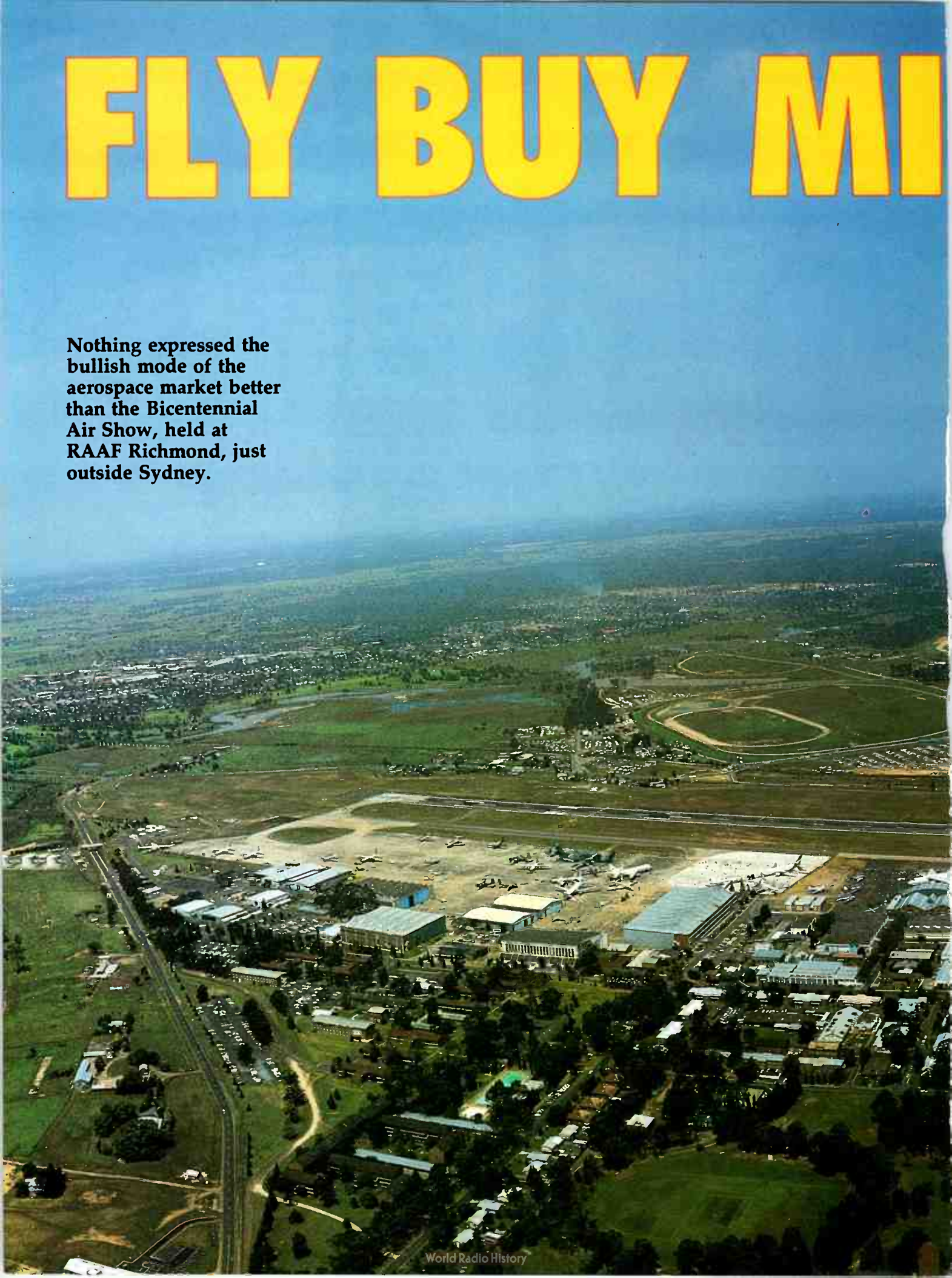
Mach have obtained substantial orders which in turn has increased Mach Systems' buying capacity, resulting in reduced cost to Mach Systems' clients.

★ ★ ★

Zenith Data Systems has appointed David Graham as account manager. Mr Graham was with the Royal Australian Navy for eight years working on specialist computer simulations before leaving in 1985 to become a PC systems support analyst for NZI.

FLY BUY MI

Nothing expressed the bullish mode of the aerospace market better than the Bicentennial Air Show, held at RAAF Richmond, just outside Sydney.



GHT High flying industry on the wings of success

TECHNOLOGY

The aerospace industry is booming. Both civilian and military aircraft makers are expecting good times between now and the turn of the century.

Civilian aircraft makers are ramping up their production lines all over the world. The International Air Transport Association, IATA, has projected that world traffic growth will increase by 13.9% this year, following a trend established in the past two years.

To meet the forecasts, Qantas will spend an extra $500 m on new Boeing 747s to bring its total investment in new aircraft to $6 b, representing 25 new jets by 1990 with an option on 14 more. This is just a small part of world-wide big jet sales which are projected at between $350 b-$510 b, equal to about 9000 aircraft before the turn of the century.

Midi jets, like the Fokker 50 and British Aerospace 146 are also flying high. Fokker has taken orders for 50 of the F50s in the past six months. BAeA has taken 23 on the 146 and another 20 on its ATP.

Nor is the civilian market the only part of aerospace that is booming. The mili-

Bicentennial air show

Supermarine Spitfire — one of the few remaining.

Cockpit of the brand new British Aerospace Hawk.

Two Trim

wo of the three motors of o Fokker motor Replico — just like Smithy's.

The Vori-Ezy (soy it very eosy) — the lost word in high performonce generol oviotion.

tary sector, which traditionally drives the whole industry, is also scrambling to keep up with orders for new technology. While peace is breaking out in some very profitable troublespots in the Third World, the major powers are rearming at a prodigious rate.

It all adds up to exciting times for the industry and they let it all hang out at the airshow. The theme of the exhibition was Aviation - past and present, and that's just what the public got. But the purpose of the event was to do business, and that's just what the industry got.

Past and present

The exhibits spanned the whole range of aviation history. SE 5As jostled with Sopwith Camels on the ground, while in the air the growl of a 12 cylinder Rolls Royce Merlin accompanied one of the

The mighty Antonov dworfs o Dokota ond the crowds.

Bicentennial air show

world's few remaining Spitfires through a couple of gentle loops and rolls. From the 1950s, Vampires, Venoms, and Sabres were put through their paces before the real crowd pleasers howled overhead. The amazing F18, mainstay of the RAAF today, rocketed down the runway before pointing straight up and disappearing into the clouds.

The miraculous Sea Harrier, pride of the Royal Navy, impressed the crowd by stopping dead still in mid air.

Then there was the giant Russian Antonov An-124, having us goggle-eyed by lumbering down the runway before wallowing into the air.

Close up, it's difficult to believe the Antonov An-124 can actually fly. Its undercarriage seems to be made up of tractor tyres and the kind of hydraulics you see on earth moving machinery.

But fly it does . . .

The British Aerospoce Horrier ot speed.

Business

Almost everybody who is anybody in the aerospace, defence and electronics industries made it to the three trade

The interior of a Goloxy.

Top prize for the world's ugliest oeroplone. The Optico is built for observotion.

British Aerospace 146 military transporter.

Left: Dutch anti—submarine;
Right: American muscle;
In between: RAAF C130

days before the public was permitted onto the airbase. The focus of their attention was the aerospace expo, a venue for all the major aerospace companies, and many of the small players, to flog their wares.

The enthusiasm with which the international contingent descended on Richmond reflects the riches in the Austra-

Kiwi Red, squadron aerobatics from the RNZAF.

lian marketplace. Australia, for instance, is the third biggest aerospace market for the US, and aerospace products from the US are our biggest single import item. Within the Asia Pacific region, Australia is the third biggest purchaser of military aircraft, the second biggest buyer of airliners and the biggest buyer of general aviation aircraft. Yearly sales are around $US1b. It's a figure that makes aviation salesmen weak at the knees.

Nor was it all just a case of foreigners exporting to Australia. Attendance at the show was boosted by some 5000 delegates from international conferences being held in the Sydney region just prior to the show. For instance, there was an international soaring convention, a Royal Aeronautical Society meeting, the 13th World Assembly of Aircraft Owners and Pilots and so on.

According to the daily press, it all boiled down to a number of significant deals for the industry. Qantas, Ansett and Australian airlines all announced significant new purchases. eti

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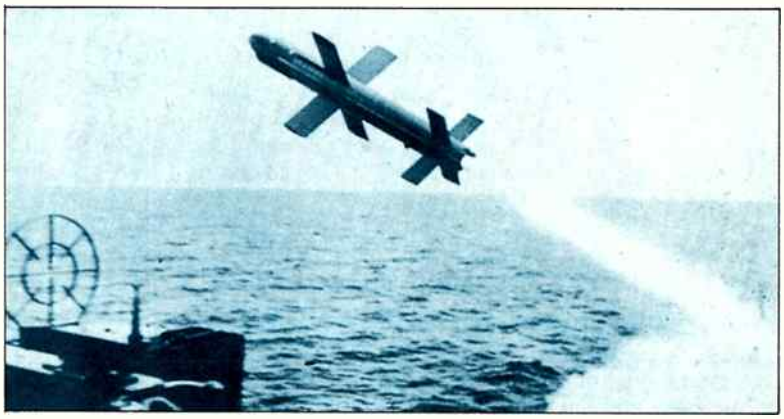
ANNA GRUTZNER

With the highest per capita debt in the world, Israel has found a sure way of earning those coveted export dollars . . . arms. Anna Grutzner describes the industry's remarkable achievement.

ISRAEL'S LETHAL LARDER



A defence industry geared for export

Israel's honoured soldier-statesman, the late Moshe Dayan, once noted "Small nations do not have a foreign policy. They have a defence policy."

Such is the *raison d'etre* behind the modern Israeli defence manufacturing sector, which has blossomed in the past decade from a local sector driven by the pressures of national survival to a key port of the broader Israeli economy.

It is timely for Australians to consider Israel's rule in the international arms trade. The Federal Government is just about to embark on its first major defence project using Israeli equipment. The Minister for Defence, Kim Beazley, announced in July the Government had awarded a $43 million contract to the Israeli Aircraft Industries (IAI) to fit aerial refuelling capability to the Royal Australian Air Force's four Boeing 707 aircraft.

Australia's previous defence dealing with Israel have been minimal. In the nine years to 1987, it bought just $14.4 million worth of defence imports, mainly aircraft spares, ammunition and some minor items. It has never exported arms or arms-related equipment to Israel. While trading in arms with Israel has been an unwritten no-no for many years among Western powers and has effectively curbed relationships in the past, the Government has privately justified its two-year deal on the basis the IAI offer was made independently of its owner-government. Moreover, the conversion work will be carried out at the Melbourne headquarters of Australian aerospace company, Hawker de Havilland.

Big business

Defence is big business in Israel. In view of the secrecy that shrouds many of Israel's dealings with export clients, estimates of the total value of the country's arms export business are difficult to make. However, most observers say the trade easily exceeds $1 billion, and that it had reached that level by 1980. The 20-fold jump in foreign earnings from an esti-

mated $50 million in 1975, illustrates what a remarkable achievement the industry has been for the Israeli economy as a whole.

More than half of Israel's military products are destined for overseas markets, compared with just 25 percent for the United States and British arms industries. Moreover, the potential export dollars figured largely in the decisions to proceed with several major projects, including the Kfir fighter aircraft, the Merkava tank, and the multirole Lavi combat fighter.

Despite setbacks in important equipment programmes and ensuing job losses in the industry, the defence sector is a vital source of "hard currency" foreign earnings for an economy otherwise deeply in trouble. With the highest per capita debt in the world — $23 billion-plus in 1984 — export income is a vital consideration to Israel. Debt-servicing alone consumes one third of Israeli government expenditure.

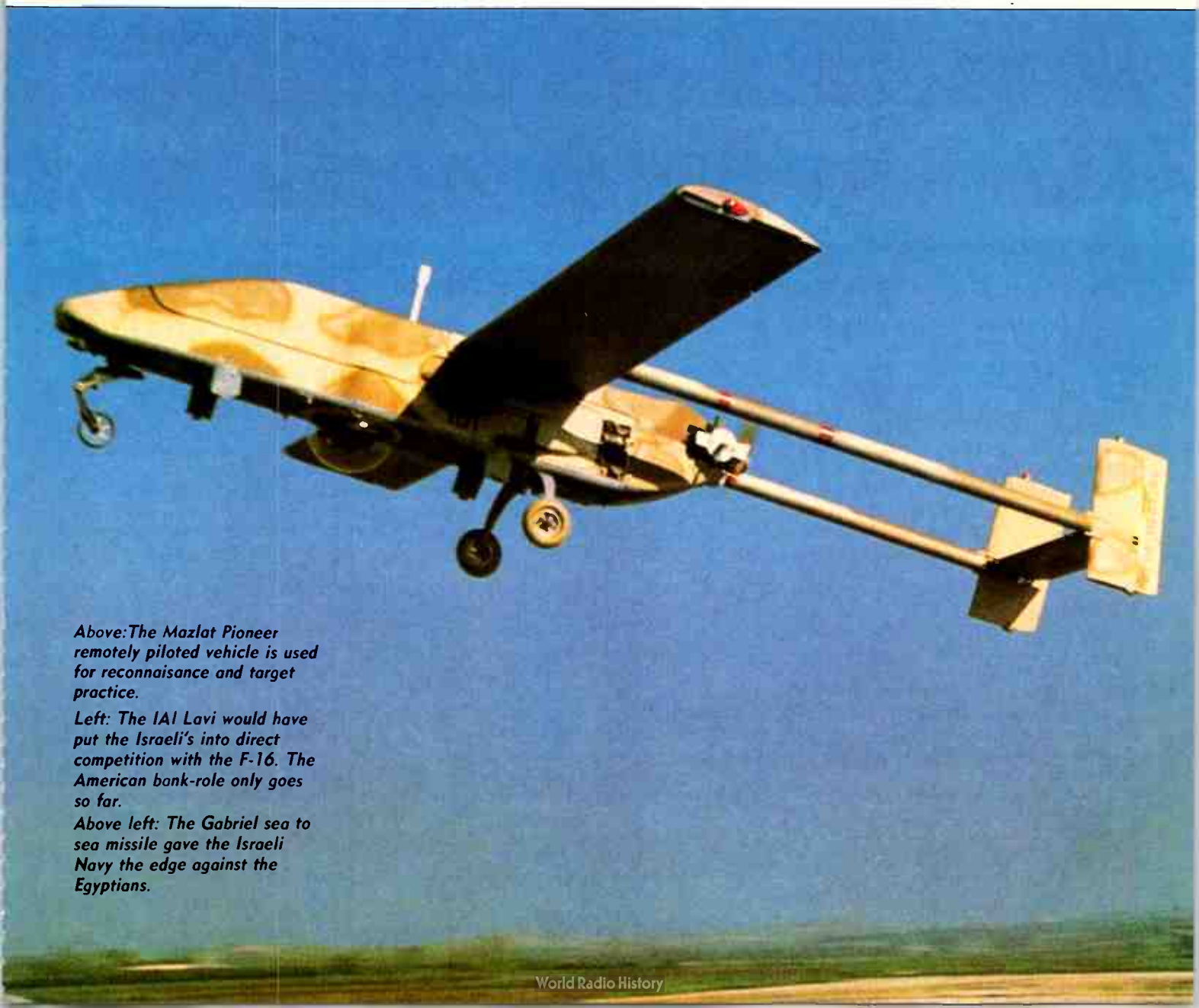
Domestic production helps limit Israel's arms import bill, thereby smoothing the balance of payments equation on the other side. It also makes for cheaper arms for the Israeli Defence Force (IDF), due to the economics of scale achieved in a bigger production run. The local industry is, moreover, better protected from the fluctuations of domestic demand driven by a single customer, namely the IDF.

Employment is another factor that weighs heavily on Israel's economic planners. About 20 percent of a workforce of some 1.3 million in 1983 was employed directly or indirectly in the defence sector. When one or other of Israel's big state-owned defence factories tightens its belt, the entire labour force shudders. Research and other industry spinoffs play a part too. As Israel's military might has been achieved largely through the attainment of technological superiority, the defence sector has passed on to other industries the fruits of innovation. The technology transferred into civilian projects is exportable too.

However, it was primarily strategic considerations which saw the defence industry flourish. Self-sufficiency became a national priority after the 1967 Six-Day War when General De Gaulle's France cut the flow of military goods to Israel, a ban still in force. In the wake of the bloody Yom Kippur War in 1973, the Israel Government devoted large sums of money and intense effort to independently securing the nation's future. The defence forces underwent a dramatic modernisation. The redundant weapons had to be offloaded. A constant capacity to produce above domestic needs in peacetime also ensures a permanent readiness for conflict.

National status

Despite its diplomatic pariah status, Israel is remarkably successful in concluding arms deals with countries across the political and geographical spectrum. Its ability to trade in arms has almost become a matter of national status. Observ-



Above:The Mazlat Pioneer remotely piloted vehicle is used for reconnaisance and target practice.

Left: The IAI Lavi would have put the Israeli's into direct competition with the F-16. The American bank-role only goes so far.

Above left: The Gabriel sea to sea missile gave the Israeli Navy the edge against the Egyptians.

ers estimate that at least 50 nations do business with Israel. While deals with some of their Third World customers carry particular risks, namely customer default on payment, those countries' often-troubled relations with their neighbours provide an endless source of demand for arms.

South Africa and Argentina, themselves on the diplomatic outer were Israel's largest clients during the 1970s. They typify Israeli clients: security-conscious middle powers with large defence budgets and very little regard for foreign relations. Within Australia's sphere of strategic influence, and potential arms export market, Israel has also made surprising inroads. It has sold arms to most of the ASEAN nations as well as Hong Kong and Japan.

Traditionally, Israel has not dealt with the Arab nations or the Communist bloc, although a secret deal with the Chinese exposed earlier this year, has put nothing beyond the realms of possibility, According to a *London Sunday Times* report, Israel has sold advanced missile technology to China. It probaby also has been helping China develop a multi-function aircraft using Lavi technology from the cancelled fighter plane project.

Israel's most complex relationship is undoubtedly that with the United States. The US is at once a source of foreign expertise and capital, an export market, an import source, and a competitor in the cut-throat world of arms dealing. Support for Israel regularly hangs on congressional doubts about the political and economical wisdom of backing the Israeli arms industry.

The US role in the aborted Lavi project well illustrates the sensitivities. Begun as a low-budget minimum capability aircraft to replace the Kfirs in 1980, the design was changed two years later to produce a high-performance fighter bomber. The Lavi became a competitor to the F-16 instead of a complimentary aircraft, and delays and consequent cost blow-outs eventually saw the venture cancelled last year.

Some suspected the US aerospace industry of helping crush the would-be rival aircraft. It was highly-dependent, not only on US capital, but on US scientific assistance. Washington pumped about US$1 billion into Lavi in the form of foreign credits. Hopes of selling it to the US Air Force were dashed by the price tag and other potential joint-partners never materialised.

The three major defence manufacturers in Israel are all state-owned enterprises. The biggest is the IAI, which began as an aircraft reconditioner with "Bedek", its aviation division. Israel Military Industries (IMI), the pioneer manufacturer, and the Armament Development Authority (Rafael) are the other two big operations.

World pioneer

Established in 1953, the IAI is also the largest single industrial exporter and the longest employer in the State of Israel. It has a workforce of 20,000 and annual sales of nearly US$900 million. While autonomously controlled as a company since 1968 it is nevertheless firmly under the government's thumb. It was a world pioneer of naval missilry and among the first to make sea missiles to station on small patrol boats.

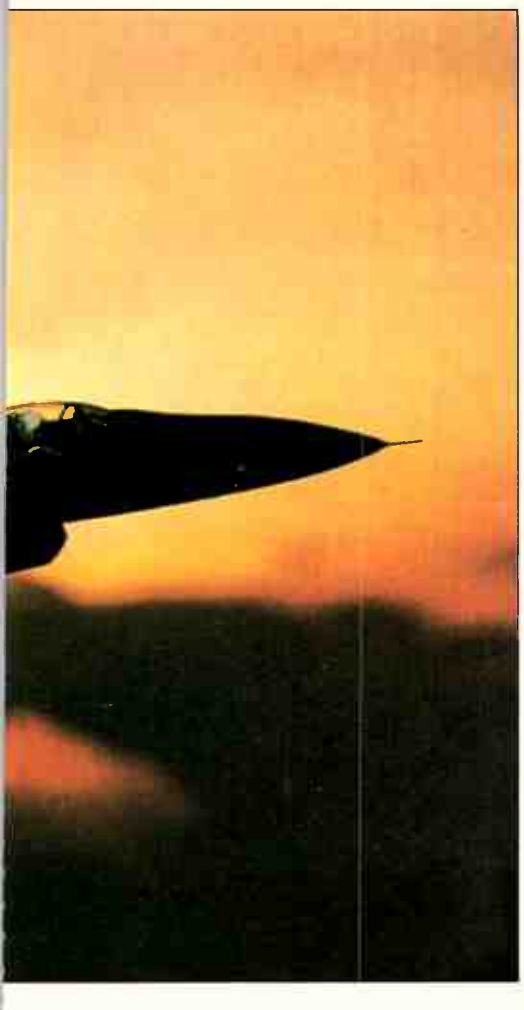
However, its most ambitious projects were the Kfir fighter aircraft built for the Israeli Air Force in 1975 and upgraded twice since, the Gabriel MK 111 missile, and the Lavi tactical fighter. The Kfir, a Mirage look-alike, competes with the Northrop F-20 on the international market. IAI is also revamping its Phantom aircraft fleet with a view to eventual exports.

Three generations of IAI Gabriel missiles have been exported in large numbers around the world, including to South Africa, Malaysia, Singapore, Taiwan and Argentina. The Gabriel is a radar-guided missile capable of being launched from an aircraft or ship to skim across water at low levels for up to 36 kms. First tested during the Yom Kippur War, The Gabriel has both fire-and-forget and fire-and-update capabilities.

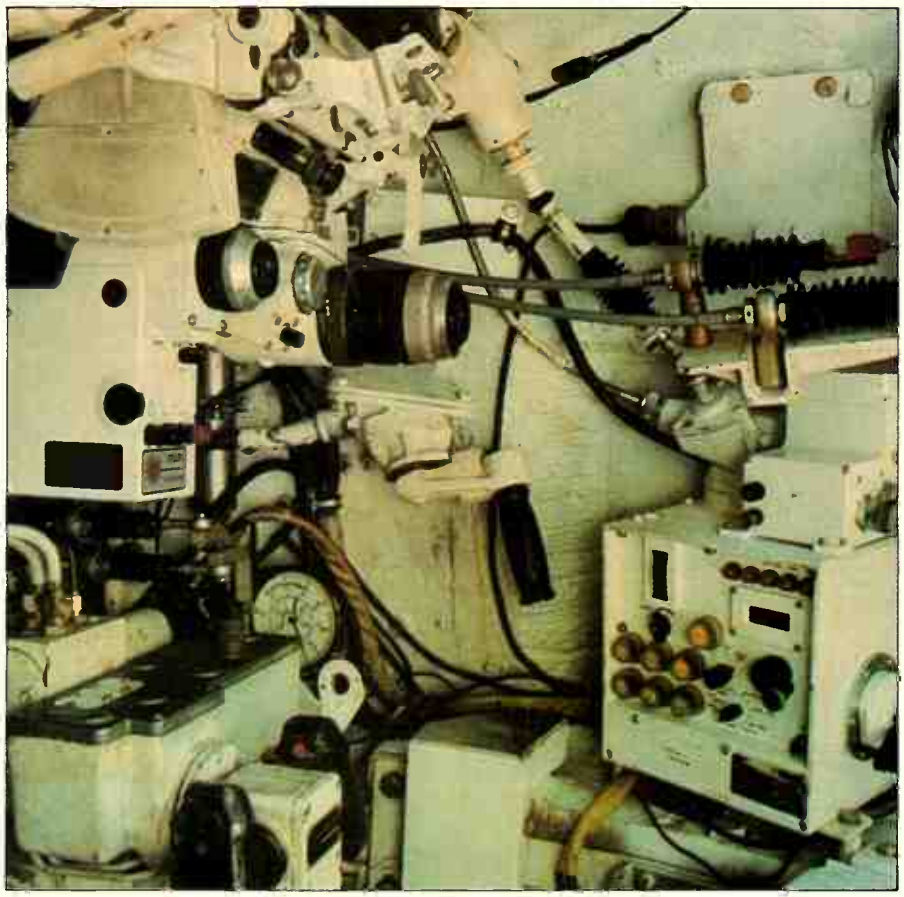
IMI's export sales have skyrocketed in recent years, from US$10.1 million in 1970 to US$288.7 million in 1980. The company began in secret in the pre-state era with export orders to some major European clients. It operates some 31 factories throughout Israel and supplies most of Israel's need for small arms and ammunition. Among its most popular export items is the 9 mm Uzi submachine gun, which is cheap, lightweight and has a proven track record in all climatic conditions. The later Galil assault rifles have also been popular for their versatility. Rocketry is another of IMI's specialities.

The Rafael Armament Development Authority is the most secretive of Israel's big defence manufacturers. Much of its work is of a technical research nature and is highly-classified. While its exports appear insignificant, the contribution Rafael technology has made to the defence industry as a whole is inestimable. As part of its export drive, Rafael has set up offices in the US, Singapore and Latin America.

In the past twenty years, Rafael has



Above: The Python III oir to oir missile.
For left: The IAI Lovi, technicolly brilliont, but the Isroeli's got the morketing wrong.
Left:The Merkovo Mork II. It con do 60 kph for 500 km ocross the desert. The interior (below) is not built for comfort.



supplied the Israeli Army with numerous weaponry and electronic warfare devices that are the absolute state-of-the-art. Best known are the Python 111 air-to-air missile, ship-defence anti-missile missile, the PDM (Barak) and a surface-to-air missile. The Python was first used in the Lebanon War in 1983 when it matched the performance of the American Sidewinder missle. It is said to be highly manoeuverable and can be launched at targets within 30 degrees of the aircraft boresight.

Israel's success in developing unmanned drones has attracted much attention. Tested in the field during the 1982 Lebanese War, the Mazlat Scout mini-RPV remotely-piloted vehicle is considered one of the most sophisticated on the market. Orders in 1983-84 surpassed US$36 million and Israel has exported the RPV to four continents. The Scout, pneumatically-catapulted into the air from a truck-mounted launcher, can not only act as a target identifier in battlefield combat but is a useful piece of maritime equipment in peacetime.

Anna Grutzner is the Canberra based defence correspondent for The Australian.

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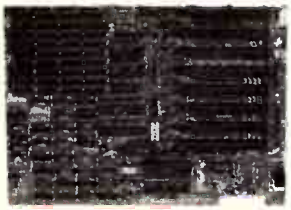

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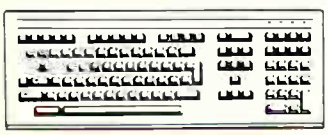

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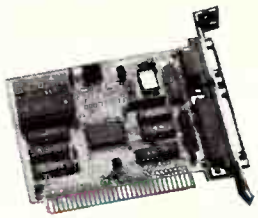

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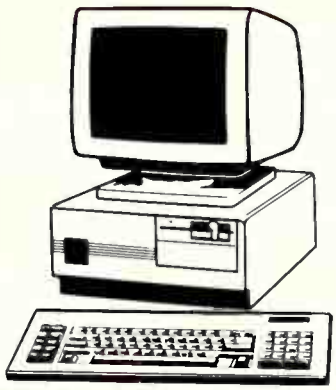

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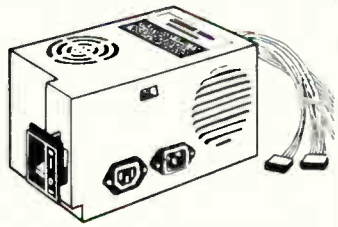

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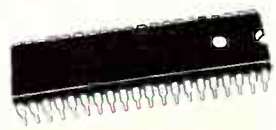

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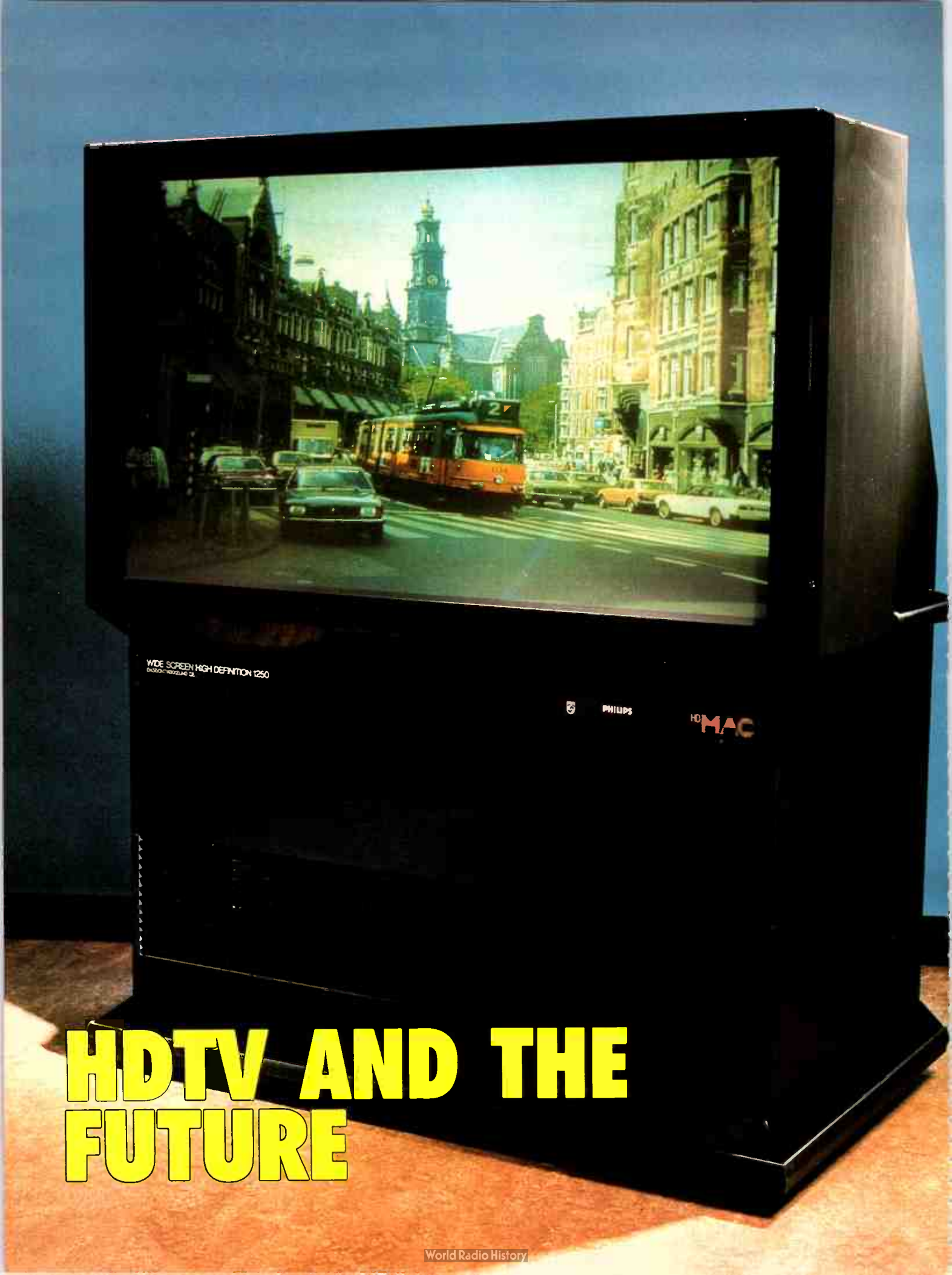

HDTV AND THE FUTURE

TECHNOLOGY

International standards for High Definition Television may be more difficult to attain than the pundits believed. Stuart Corner surveys developments and decisions made so far.

A blow for Japan, a boost in the US and a Seoul exposed...

Global HDTV in doubt

Hope is fading that a single international standard will evolve for the technology of High Definition Television (HDTV). The US Federal Communications Commission (FCC) has laid down guidelines for a standard that would be incompatible with either of the two contenders from Europe and Japan. The decision is believed to come as the result of strenuous lobbying by the three major US broadcasters who argue that HDTV could make the 140 million TV sets in the US obsolete. There are also fears that HDTV could see the end of the US domestic TV industry, now reduced to a single manufacturer, Zenith. The FCC is not expected to decide on a standard before 1990.

HDTV looks set to be the next consumer electronics boom market. Estimates in the US put the domestic market as being worth $US30 billion by 1997.

HDTV uses 1125 lines compared to the 525 or 625 line used in present systems. This increased scanning rate coupled with higher horizontal resolution gives picture clarity comparable to a photographic image. HDTV screens also use a wider aspect ratio than the present system.

The standard proposed by Japan requires a signal of 30 MHz bandwidth and is not compatible with existing systems. The FCC guidelines specify that the signal must have the same bandwidth as present transmissions (6 MHz) and must be able to be received by existing receivers. The signal must also be suitable for transmission via cable, satellite or cirect broadcast. Japan's national broadcaster NHK has a devised a means of compressing the 30 MHz signal into 8 MHz but this is still too wide to meet US requirements, is incompatible with existing receivers and does not always give perfect reproduction.

A number of companies including Philips North America have come up with suitable standards. The Philips system uses two 6 MHz channels. One carries the same information as the present signal and can be used by a standard receiver. Additional information is carried on the second channel. The HDTV receiver combines the information on both channels to create the HDTV image.

HDTV is also being heralded as one of the major forces which will drive the penetration of optical fibre based broadband communications networks to domestic subscribers. A digitised HDTV signal has colossal bandwidth: 120 Megabits, but Bell Research in the US recently demonstrated transmission at 42 Megabits per second, said to be indistinguishable from 120 Megabit transmission. However, 120 Megabit transmission would still be required for transmission from studio to studio.

Japan is by far the most advanced in plans to bring HDTV into people's homes Japan staged the first international transmission of HDTV to the Japan pavilion at Expo 88, in July. It also installed over 800 HDTV sets in 50 locations around Japan to provide coverage of the Seoul Olympics. In 1990 NHK will commence public broadcast HDTV services via a specially launched satellite.

Japan defeated?

Japan presently leads the world in the development of High Definition Television (HDTV), but it may be forced to bow to pressure from the US and Europe, abandon its home-grown standard and develop equipment to match their competing standards.

Japan's dominance of HDTV received a severe blow in September when the US Federal Communications Commission laid down specifictions for high definition TV standards which precluded the Japanese developments. The FCC ruled that HDTV signals must be compatible with existing receivers.

Now, after a concerted two-year effort, a European consortium has demonstrated a complete HDTV system — production, transmission and reception — at the International Broadcasting Convention held in Brighton, UK, recently. The Eureka consortium, comprising 30 European organisations, was formed in 1986 after European nations vetoed Japanese HDTV proposals put to the CCIR Plenary meeting in Dubrovnik, this veto forced the CCIR to delay its decision to the 1990 Plenary.

Eureka's president, P. W. Bogels, international director of Philips Consumer Electronics Division, predicted that the successful demonstration of the Eureka system, which offers compatibility with existing receivers, combined with the FCC declaration, would force the Japanese to change their technology for both domestic and export markets. "The alternative is for them to make three systems: one for themselves, another for the US and a third for Europe, and I can't see them doing that", he said.

Bogels forecast that the Japanese manufacturers would develop new systems compatible with the emerging European and US technologies. Even though handicapped by a late start, he predicted that the Japanese manufacturers would be tough competition for European and US manufacturers. "Time is now against them. But even allowing for that, we must be very very quick and very very good", he said.

HDTV

The Eureka F1195 standard uses a 1250 lines scanning system with a 58 Hertz frequency, making it compatible with 35 mm cinema film. The Eureka partners are Philips, Thomson, Bosch, Thorn EMI, and over 30 research establishments and broadcasters.

The Consortium will submit its standard to the CCIR Plenary in 1990. Philips has developed a variant of the system suitable for the North American market which it hopes will be accepted by the FCC. The first HDTV receivers are expected to come on the market in the US in the early 1990s.

Compatibility boosted

The decision of the United States Federal Communications Commission to opt for HDTV compatibility, thus ruling out Japan's Muse system, has been welcomed by Philips. Bogels said, "We are delighted that the philosophy we established two years ago when we launched the Eureka project — that it should be based on a compatible approach — has been accepted.

"It is particularly pleasing because there were doubts at the beginning as to whether the project could be carried out in the time available. The Japanese were already there with their equipment and we only had thoughts written down on paper.

"However, the FCC decision is, in a way, only our first hurdle in the United States. There is no guarantee that the Philips system will be eventually chosen, although, as the FCC says, we are a very strong candidate and we have a very good chance.

Intelsaturated

The demand for international satellite TV circuits for the Seoul Olympics pushed the capacity of the Intelsat international satellite network to the limits.

A total of nine satellites provided 32 simultaneous TV channels for Olympic transmission, including a High Definition TV transmission for viewing on public HDTV screens in Japan. Demand for capacity on Intelsat's Indian and Pacific ocean satellites was so great that near saturation level was reached on the TV channels in these satellites.

Intelsat in October awarded contracts to Ford Aerospace for at least five new Intelsat satellites, to be known as Intelsat VII. The first two of these are scheduled for launch in 1992 and 1993 to replace Intelsat V satellites presently serving the Pacific region. They will greatly increase the number of TV channels available.

DATES, DECISIONS AND DEMOS

May 1986: The CCIR meets in Dubrovnik. The Japanese submit their HDTV production system for adoption as the world standard. The system is incompatible with existing television equipment. The Europeans form a bloc and the CCIR postpones its decision to its next plenary session in 1990.

July 1986: Eureka 95 project launched to define a European HDTV standard derived from the D2 MAC that would be compatible with existing equipment and that could be adopted by the CCIR in 1990. Eureka 95 brings together industries (Philips, Thomson, Bosch, Thorn EMI), broadcasters (BBC, RAI) and 30 research laboratories and establishments (e.g: CCETT, IBA). The project is allocated financing of 200 million ECUs over 3 years.

June 1987: At Montreux, a prototype b/w camera, relying on progressive scanning techniques, is exhibited, and demonstrates the technical feasibility of the European project. The Japanese — whose first attempts to develop HDTV date back ten years or so — had claimed earlier that progressive scanning with more than 1000 lines was technologically impossible.

August 1987: The EUREKA EU95 stand at the Berlin exhibition presents an overview of the entire project, from D2 MAC to HDTV.

October 1987: Meeting of the CCIR in Geneva ratifies the existence of a European project to develop an HDTV standard.

November 1987: Japan launches a major campaign to safeguard its domestic HDTV market. All Japanese HDTV equipment (production, transmission, reception and reproduction) is promoted under the registered trademark HiVision.

December 1987: NBC recommends that the United States Advanced Television Systems Committee (ATSC) drops plans to switch to the Japanese HDTV standard and opts for a standard that would be compatible with NTSC. "NBC believes that industry's needs will eventually result in two backward compatible HDTV standards for television, at 1050/59.94 and 1250/50. A third standard at 1125/60 serves no purpose."

January 1988: In the United States, the National Association of Broadcasters (NAB) comes down in favour of the NTSC compatible standard (1050/59.94).

Summer 1988: Completion of the entire image chain developed to Eureka 95 standards, including first colour 1250/50 progressive scanning camera.

September 1988: In the United States, the Federal Communications Commission, in a unanimous vote, approves the general technical parameters that broadcasters must follow in transmitting High Definition Television. Under the guidelines, transmission of high definition signals must assure that consumers will not have to buy new television sets when the system begins operating (NTSC compatible system). Also, the International Broadcasting Convention (IBC) was held at Brighton, in the UK. Second public presentation of European equipment and public debut of a complete, operational European HDTV image chain.

TECHNOLOGY

Kathryn M. Doolan describes how the beleaguered American manned space program received a desperately needed morale boost with the blast-off of STS 26.

VOYAGE OF DISCOVERY

NASA regains confidence with STS 26 launch

After the Challenger disaster of 1986, the STS 26 flight in late September, 1988 is being hailed by NASA officials as the first step to getting the space shuttle regularly back into space.

It was in January 1987 that NASA announced that the space shuttle would launch in February 1988. At that time the date seemed to be overly optimistic, and by the time the shuttle was ready to go it was September. The redesigning of the troublesome Solid Rocket Boosters (SRB) and other areas of the orbiter were the main reasons for the delays.

Discovery was rolled on to Pad 39B at the Kennedy Space Centre on 4th July, 1988, from the vehicle assembly building where it had undergone checks and mating with the external tank and solid rocket boosters. During check out tests later that week it was found that the "O" rings of the Solid Rocket Boosters had lost ten inches of insulation and that was replaced. Another problem arose when a technician smelled a "fishy" odour.

The odour was discovered during an inspection of the Orbital Manoeuvring System (OMS). It was found that the odour was the highly toxic chemical Nitrogen Tetroxide coming from the left OMS pod. The chances of NASA engineers repairing the leak on the pad appeared slim, until the leak was halted by filling the pod with nitrogen which forced the textroxide back into its tank.

The scheduled flight readiness firing of the Space Shuttle main engines was delayed until 4th August. On that day the countdown proceeded until the T minus ten second point when a cut-off occurred. The problem was with the launch sequencer which inhibited starting commands. The faulty sensor was replaced and on 10th August, the main engines were fired at full capacity for 22 seconds instead of the scheduled nine seconds.

Further delays with the repairs of the OMS pod pushed the launch date back until the last week of September. Departing from tradition, NASA managers refused to name a specific launch date

saying only that the launch would come between 24th and 30th September.

With the launch drawing closer, a conflict developed between NASA and the United States Air Force. The Air Force had declared that the area around the Kennedy Space Centre was unsafe for civilians and the only people who should be on KSC grounds during shuttle launches should be military personnel. NASA, who use shuttle launches to help build their grass roots support were appalled by the idea, and negotiations began for a mutually acceptable compromise. The media representatives (nearly 15,000) were pooled and only 7000 were allowed on KSC grounds. Restrictions were also made on the number of guests invited.

Concerns overruled

Changes were also made in the shuttle launch decision processes. When 51L launched in 1986, "flawed" management was seen as a contributing cause to the accident. The night before that launch (27th January, 1986), NASA managers overruled contractor concerns about ice and "O" rings and the flight was allowed to proceed. This time the final launch decision rested with Bob Crippen — the first astronaut to fly the shuttle four times. Senior NASA managers also played a larger part in launch decision processes — previous shuttle launches were approved by lower or middle level managers.

On 23rd September, President Reagan farewelled the STS 26 crew at the Johnson Space Centre in Houston. The crew, consisting of Commander Rick Hauck, Pilot Dick Covey and Mission Specialists Pinky Nelson, Mike Lounge and Dave Hilmers, then flew to the Kennedy Space Centre by NASA T-38 jets. Leading up to the launch the crew trained in simulators and Hauck and Covey practised landings in the NASA Gulfstream jet which had been modified to act like the shuttle on landing approaches.

The launch date of 30th September was fine and clear at the Kennedy Space Centre, however, there was worry about high altitude winds, and the launch was delayed by 90 minutes. Finally, at 11:37 am (American Eastern Daylight Time), some 32 months after Challenger, Discovery launched. One hour after launch, heavy thunderstorms and gale force winds whipped through the Kennedy Space Centre.

Moment of tension

The first two minutes of Discovery's flight were seen as the most crucial moments of the mission. The SRBs, which had been extensively redesigned after Challenger, performed perfectly. When they were recovered, NASA officials stated that there were no signs of "O" ring erosion or burn through. There was a moment of tension just before SRB separation when a flicker of flame was spotted coming from the right SRB. A public affairs officer from the Kennedy Space Centre told me that they were unsure about the origin of the flame but stressed that no burn through had taken place.

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plans were made for the deployment of the Tracking and Data Relay Satellite (TDRS) the main payload of STS 26. TDRS-C is the third in a series of communications satellites NASA will be using for further radio communications with the space shuttle and other scientific probes such as the Hubble Space Telescope. It will also mean the phasing out of several ground stations. The first TDRS was deployed in April 1983 and the second one aboard Challenger on its final flight. Six hours into the mission, TDRS-C was deployed and without any major problems was propelled to its station, 22,300 miles above the Pacific Ocean.

Once TDRS-C was deployed, the crew's attention turned towards the secondary experiments which were stored on Discovery's mid deck. One experiment of interest to Australians was the Aggregation of Red Blood Cells (ARC) designed by Dr Leopold Dintenfass of Sydney. Blood samples from donors suffering medical conditions such as heart disease, diabetes and cancer were flown. The experiment was designed to provide information on formation rate, structure and organisation of red cell clumps, as well as the thickness of whole blood coil aggregates at high and low flow rates. This will determine if microgravity can play a part in new and existing clinical research and medical testing. The ARC experiment first flew on STS 51C in January 1985.

Environment tests

Other secondary experiments included a protein crystal growth experiment, an infrared communications experiment, and two student experiments on crystal growth and metal strength-testing. One experiment, The Orbiter Experiments Autonomous Supporting Instrumentation System (OASIS) was mounted in the payload bay and was used to determine the environment experienced by Discovery during its flight. Information collected by OASIS will include the effects on the orbiter of temperature, pressure, vibration, sound acceleration, strain and stress. It will be used for the development of future upper stages and payloads.

One of the more common technical problems taking place on most space shuttle flights is the breakdown of the toilet and this flight was no different! Another small but uncomfortable problem was ice clogging the flash evaporation system which is responsible for cooling the interior of the orbiter during the ascent and descent phases. The crew sweltered as the temperature was raised to 27°C in an attempt to melt the ice.

During the traditional in-orbit press conference, the five astronauts paid tribute to the seven astronauts who died in the Challenger blast. Reading from a prepared statement, Commander Rick Hauck read "Today where the blue sky turns to black, we have resumed the journey that we promised to continue for you . . . Dear friends your loss has meant that we can confidently begin anew, and your spirits and dreams are still alive in our hearts."

The final day of the mission was spent stowing gear, testing equipment and running through the landing checklist. The spacesuits that are now compulsory wear for shuttle crews were checked and final weather checks were made of the primary landing site at Edwards Air Force Base.

After 64 orbits, Discovery made preparations to land, and after a flight of just over four days, Commander Rick Hauck and Pilot Dick Covey landed the orbiter using manual control. There were no braking problems and once the orbiter was declared safe by ground crews, the astronauts were greeted by nearly half a million people as well as Vice President George Bush who was roundly criticised by the media for using the event to further his presidential aspirations. After spending six days at Dryden Flight Research Facility at Edwards, Discovery was mated with the 747 Shuttle Carrier Craft and flown back to the Kennedy Space Centre for post-flight inspection. Once that is completed, it will be prepared for its next mission.

Next . . .

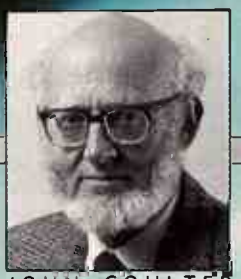
The next shuttle flight will be a classified Department of Defence mission, which is due to launch as we go to press. It is expected to deploy a "Keyhole" reconnaissance satellite. With classified DOD missions, the launch is kept secret until two or three hours beforehand, all communications between the orbiter and mission control are kept secret and only short bulletins are issued periodically. Landings are also a guarded secret with the media and the public only being informed an hour before landing.

With the return of the shuttle to flight, NASA have now announced that they will eventually build up to 14 flights a year. In the next two years we should see the long awaited deployment of Galileo, Magellan, and finally in 1990 the launch of another teacher as well as the Hubble Space Telescope. Other highlights will include an astronomical Spacelab, the much delayed ASTDRO 1 mission and, depending on election results, the beginning of the Space Station "Freedom".

The emphasis on the space shuttle for the past 32 months, and its tragic ending in 1986, will hopefully give way to the future of the space shuttle and a new beginning for the American manned space program.

Kathryn M. Doolan is a regular contributor to ETI as a freelance writer on space technology.

POLITICS



JOHN COULTER

OZONE DEGRADATION

Cautionary tales from the stratosphere

Atmospheric pollution is shaping up to be one of the most important technical problems of the 1990s. John Coulter provides a little history and points out some solutions.

Tale No 1

When General Motors chemists synthesised the first chlorofluorocarbons (CFCs) in 1928 they, and many others, thought they had discovered a class of wonder chemicals. They were remarkably inert, non-inflammable, relatively non-toxic and they came with differing physical characteristics such as boiling points which made then seem ideal for a wide range of applications. Little did they realise that chemical stability is a two edged sword.

(CFCs) are hydrocarbons of the parrafin series in which all or some of the hydrogen atoms have been replaced with chlorine and fluorine. One and two carbon members with total substitution are in widest use and these are also very stable.

TABLE 1

Freon 11	$ACFCl_3$
Feron 12	CF_2Cl_2
Freon 22	CHF_2Cl
Freon 113	$C_2F_3Cl_3$
Freon 114	$C_2F_4Cl_2$
Freon 115	C_2F_5Ci

Prior to the synthesis of CFC's toxic gases such as sulphur dioxide and ammonia had been used for refrigeration. The new gases came into very wide use in refrigeration and air-conditioning and gradually their use also extended to aerosol propellant, plastic foam expanders, dry cleaning and degreasing electronic components, chips and circuit boards.

It was not until the early 1970s that two American chemists posed a very simple question; a question that should have been thought about much earlier. Rowland and Molina, noting that CFCs were very stable, had been released to the atmosphere in hundreds of thousands of tonnes, were not soluble in water and therefore not going to be removed by rain, asked, "Where have all these molecules gone?" The only natural site of degradation they could hypothesise was the stratosphere where they argued the intense short wave ultra violet light coming from the sun would be energetic enough to break these mocules down.

They then quickly realised that this process was likely to release atomic chlorine which would degrade ozone. It is stratospheric ozone which protects the Earth from the high energy short wave UV which is so destructive to many biological processes. The reactions hypothesised by Rowland and Molina have now been shown to occur in nature together with a number of other reaction pathways. The principal reaction is catalytic. For both these reasons actual ozone depletion has been found repeatedly to exceed computer predictions.

$$\begin{aligned} Cl + O_3 &\rightarrow ClO + O_2 \\ CLO + O_3 &\rightarrow Cl + 2O_2 \end{aligned}$$

Tale No 2

When the British scientists on several Antarctic Islands first found they were recording very low levels for stratospheric ozone during the Antarctic spring they believed there must have been something wrong with their measurements and for several years these observations were ignored.

When consistent measurements were noted from several ground stations in Antarctica, the Americans were asked to compare their ozone measurements from a Nimbus satellite. But the Americans had assumed there would be no readings below a certain figure and had programmed the on-board computer to reject all low readings. Consequently the readings which could have verified the ground based measurements were not available.

Subsequently, when the computers were re-programmed during the course of this Antarctic spring, ozone reduction was confirmed. Over the past ten years ozone levels over the Antarctic have declined by 60% during spring. Average global decrease is about 2.5%, less at the Equator, greater toward the poles.

Next to nuclear war, ozone depletion may be the most serious threat to life on the planet, for life could not exist in the open on land if it were not protected from shortwave UV. CFC 11 and 12 take about five years to reach the stratosphere after release and once there persist for about 100 years. Taken together with the catalytic nature of ozone degradation these further facts mean:

★ Ozone decline will continue for some time even if stringent control measures are applied.
★ Reductions in CFC release exceeding 85% need to be achieved as quickly as possible.

'Reductions in CFC released need to be achieved as quickly as possible'

Tale No 3

Alerted to the problems of ozone depletion the UN Environment Programme brought nations together under the Vienna Convention. After a number of meetings over several years the Montreal Protocol was agreed in September 1987.

This protocol sets the reference year as 1986 and calls for a freeze of CFCs at 1986 levels, a reduction of 20% by 1993 and 50% by 1999. These figures apply to industrial countries with use exceeding 0.3 kg per head. Countries with a smaller per capita consumption may increase their consumption to 0.3 kg per head.

The significane of the latest point is amply illustrated by the example of China which has 60 times Australia's population but, per head, uses CFCs at only 1/45th our rate. If China's CFC use rises to the Montreal Protocol's 0.3 kg per head limit and all industrial nations cut production by 50% there will be six times as much CFC in the stratosphere two centuries from now.

The lessons are these:

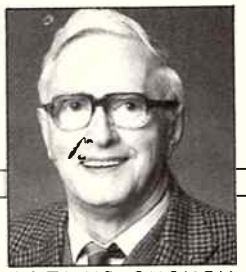
★ Nature is not an infinite sink.
★ Stability is a mixed blessing.
★ Political process is slow.

Political response

The Australian Democrats have a Bill before the Senate aiming to reduce CFC emissions by 95% by banning unnecessary use and recycling in all other applications. The Government has signalled that it intends to introduce legislation this session but its Bill has not yet been seen. It is anticipated both Bills will be debated this session.

So hang on to your hats. But above all keep yourselves well covered with UV screen creme this summer. eti

Senator John Coulter is the spokesman for the Australian Democrats on Science and Technology.



ARTHUR CUSHEN

DEUTSCHE WELLE EXPANDS

Major changes in programme content

This month Arthur Cushen reports on the kilohertz scene in Germany and the new powerful transmitters in Jordan.

The Voice of Germany, Deutsche Welle, at Cologne, has combined its English regional programmes into one service and has announced further exponsion of its relay facilities and the use of international broadcasts transmitters in other ports of the world to improve its reception quality.

There have been some major changes in the programme content, but the scheduling and frequencies remain almost the same.

The first overseas Deutsche Welle relay base was built in Central Africa. Twenty-six years ago, on August 20, 1963, Deutsche Welle began transmitting from Kigali in the Central African state of Rwanda. This was the first step in building up a network of relay stations. The Rwanda transmitting station, whose output potential will be increased this year from two to four 250 kW shortwave transmitters, was followed by other stations in Portugal, Malta, Antigua and Montserrat.

Headquarters of Deutsche Welle at Cologne, Germany.

'. . . the first step in building up its network of relay stations'

A further transmitting station at Trincomalee in Sri Lanka is finally commencing operation. Because of the unrest on this island in the Indian Ocean, the inauguration of the station was delayed time and again. With three 250 kW shortwave transmitters and one 400 kW medium-wave transmitter, the Trincomalee relay station will play a major part in improving the reception quality of Deutsche Welle programmes for listeners in Asia.

Another area of expansion of Deutsche Welle is the leasing of time on international stations, and broadcasts are now relayed by Radio Braz at Brazilia in Brazil for reception in Central and North America.

The present schedule of English broadcasts to Australia is 0900-0950 on 6160, 11945, 17715, 17780, 17875, 21650, and 21680 kHz, 2100-2150 on 7130, 9650, 9765 and 11765 kHz, while programmes in German are also carried to the South Pacific at 0600-0800 on 6075, 7285, 9545, 9690, 9735, 11705, 11785, 11795, 17825, 17845 and 21560 kHz.

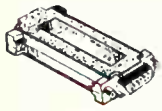
Jordan's higher power

New powerful longwave, mediumwave and shortwave transmitters are being installed in the Kharanah area. The transmitting station will use three 500 kW shortwave transmitters which will cover North and South America, Europe, North Africa and the Middle East.

The station will also include a 1000 kW mediumwave transmitter that will cover the Arabian Gulf, Saudi Arabia and Iraq, and after dark North Africa with high efficiency. There will also be two longwave transmitters with an overall power of 1200 kW to ensure day and night time coverage in all neighbouring countries.

The transmitting station is equipped with an electronic control room directing the giant antennas as well as powerful electric generators. Test transmissions from this station will begin in late August this year. eti

This item was contributed by Arthur Cushen, 212 Earn Street, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All items are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time.



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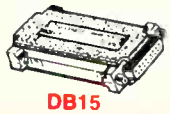

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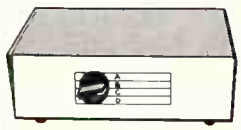

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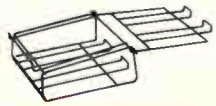

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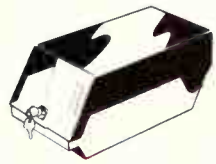

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CHECK THESE FEATURES...

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- 4½ digit x ½" (H) LCD
- Audible continuity tester
- Push-button ON/OFF switch.
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CHECK THESE FEATURES....

- Push-button ON/OFF switch.
- Audible continuity test
- Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- Transistor test
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- Cap features built-in flint for igniting Portasol tip
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- Black epoxy finished metal floor speaker stands. Base slope is adjustable to allow you to find the correct listening position for your speakers.
- Holds speakers witha minimum dimension of 220 x 190mmm
- Maximum speaker weight 30Kg
- Stand height 125mm
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- Leg studs to stop slipping and vibrating on carpets are easily removed for smooth tile floors.

C10768 ..... **$99.95**

ROD IRVING ELECTRONICS

ROBERT IRWIN

Lost in the city maze of traffic snarls, bottlenecks caused by road repairs and confused by the street directory? Robert Irwin describes Autoguide — a system to avoid all that and more . . .

AUTOGUIDE

Your personal navigator

With more cars now on the road than ever before and traffic systems full to overflowing, getting from point A to point B is no longer the Sunday drive it used to be.

Just ask any of the drivers from the numerous courier fleets bulging from this year's Yellow Pages. How many of us have been in that most untextbook-like of driving positions with the street directory precariously balanced on the steering wheel, one eye on the street sign flashing past the side window and the other squinting to decode the multi-coloured mosaic on the page in front only to find the road continues on map 41?

In Europe, with more than 200,000,000 registered vehicles on the roads, the problems of increasing traffic flow and accident rates have, over the past few years, given rise to a lot of research and development on methods of improving road systems and the vehicles that use them.

One interesting project has recently reached the demonstration stage in England. Called "Autoguide", it is an interactive guidance system developed for road vehicles which, when fully operational, will be capable of guiding a driver, via the best route, through the maze of streets to within ten metres of any destination in London and, ultimately, all of Europe.

Other features include the ability to update the driver on current traffic conditions and so avoid congested and problem areas.

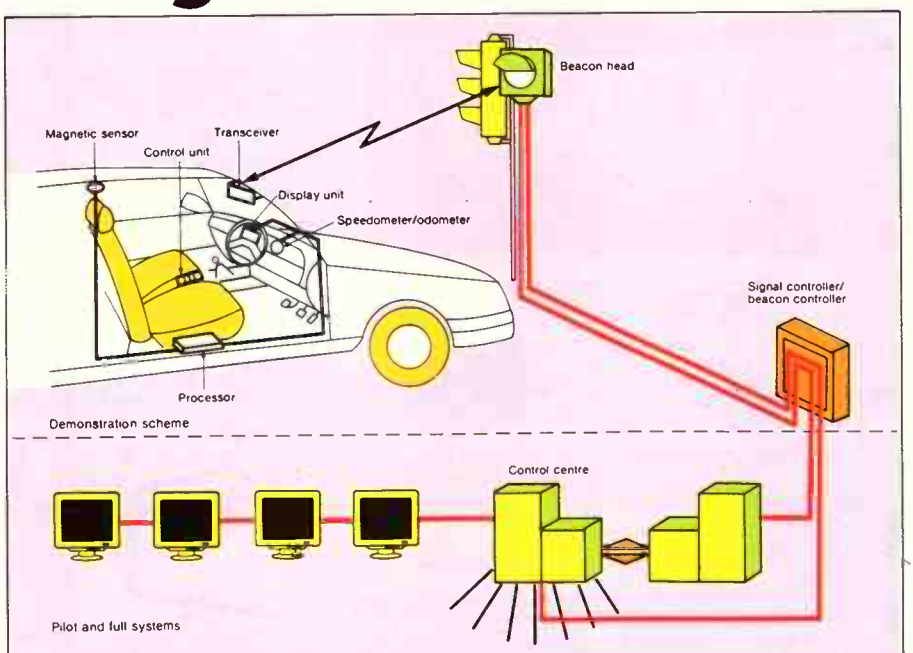

Figure 1: The Autoguide System. The roadside beacon transmits a "map" to the vehicle with information on present traffic conditions. The in-car equipment decodes the information and guides the driver along the best route. The control centre co-ordinates all traffic and routing information.

Navigation aid

Route guidance systems for road vehicles are not a new idea. Research has been going on for years in the USA and many European countries, notably West Germany, into systems to aid drivers in navigating the ever-increasing complexity of the road systems.

In September 1986 the British government released a paper outlining the work done by their own Transport and Road Research Laboratory on such a system and, in April of 1987, after much discussion with industry, local authorities, police and those working with similar projects overseas, the Department of Transport announced that an on-street demonstration of the so-called Autoguide system would be commenced in London.

This demonstration scheme was to provide complete route guidance in a corridor between London's Heathrow airport and the city centre and would enable the practicality of the system to be evaluated as well as providing a means to suitably impress those holding the industry purse strings.

The heart of Autoguide is a dashboard mounted display unit and the computerised navigator attached to it.

The idea is that a driver, at the start

of a journey, enters in his present position and where he wants to go. Autoguide then calculates the best route to take and gives the driver directions via the display terminal.

The display is quite graphic in nature and gives information on where and which way to turn as well as additional hints on which lane to get into on high-

guide to dead reckon the car's position at any given time.

This means that the system can navigate from one place to another without any outside help. Dead reckoning itself, however, is of limited use as the accumulated errors would soon get you as lost as when you'd started. The power of the system comes from it's ability to

'While the kids settle down in the back seat you punch in a two digit code for the beach'

ways etc.

An optional voice synthesis circuit is included so that the driver doesn't have to continually stare at the screen and frees his eyes for an occasional glance at the road! A magnetic sensor mounted in the roof of the car gives the processor information on the direction the car is heading and connections to the speedo and odometer allow Auto-

communicate with the outside world.

Electronic signposts

At main road junctions small infra-red roadside beacons act as electronic signposts and transmit to the car accurate information on its current position and a detailed map of the surrounding area.

Every time the car passes a beacon its on-board navigator is updated. This avoids the error build-up from the dead reckoning process and also allows the amount of memory needed in the car to be minimised as only a map of the immediate area is stored.

Infra-red transmitters in each beacon will send information at the rate of 125,000 bits per second and the beacons themselves would be mounted on existing traffic lights where, in most cases, the power and spare cables would make installation economical and easy.

Central control

Each beacon would be connected back to a central control unit which would co-ordinate the overall traffic flow and transmit up-to-the-minute information on traffic conditions to the on-board processor.

This would allow dynamic re-routing of cars if, for instance, an accident was causing delays at a certain intersection or road works were under way on porticular streets.

The setup and organisation of this control centre will be of major importance to a full commercial Autoguide system.

A flow of detailed and current information on all areas likely to affect traffic flow will need to be maintained for the system to be effective.

To this end the transfer of information between beacon and car will be made two way.

An infra-red transmitter on the car will send "stop watch" information to the beacon on the time taken to cover the route followed from the previous beacon.

The beacon sends this information to the central control which uses it in the calculation of traffic flow.

This flow information, in turn, is passed back to the beacons in a classic "feedback loop" and allows the car's processor to change the route to avoid potential bottlenecks. It is hoped that this dynamic re-routing will smooth out traffic flow in the centre of cities and avoid the problem of one route becoming too heavily congested.

Information from police, the Automobile Association, the Department of Road Transport and other sources would be gathered to keep the central controller up to date on road conditions, road works, accidents and other factors that might affect the journeys of motorists and allow the choice of the quickest route.

The demonstration system

Since April '88 this year a demonstration system for Autoguide has been operating between the centre of the London Westminster area and Heathrow airport.

Twelve vehicles have been fitted out and five beacons set up at strategic intersections. In the demonstration the beacons act independently and aren't connected to a central control which means that the information gathering and dynamic re-routing facilities won't be fully operational.

Their function, however, can be simulated by manually feeding the beacons updated traffic information.

The purpose of this demonstration system is that, firstly it should provide valuable information and experience for engineers that are likely to be working in the development of a full-scale system and secondly, it should help in the integration of work done in the field by countries other than Britain.

The European communities as a whole are keen for collaboration and the setting up of standard guidelines so that eventually the whole of Europe could be covered by compatible systems and not run into the problems of differing standards existing in other areas.

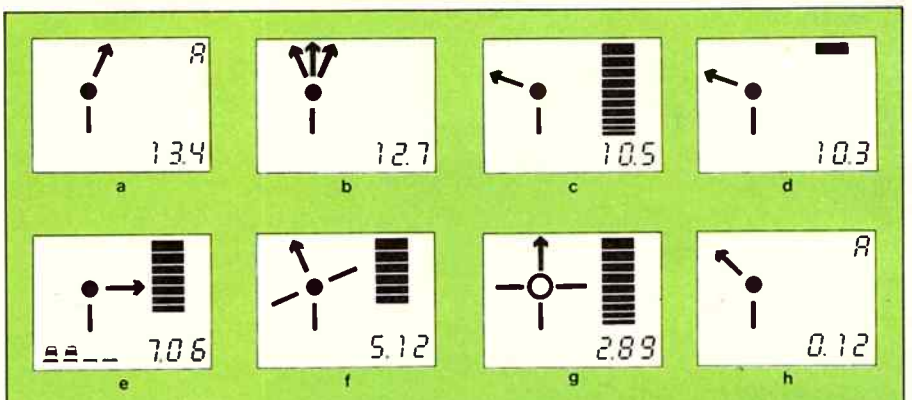

Figure 2: Display examples
a) & h) Compass direction and "crow fly" distance to destination.
b) Follow road ahead even if it twists and turns.
c) & d) Indication to turn. The bar graph on the right of screen "counts down" the distance to the turn.
e) Lane information can be included.
f) Indication of a complex junction.
g) Indication of a roundabout with the exit marked.

Industry funded

One final, and important, role for the demonstation system is that of the salesman.

The British government, though supporting the initial research, has decided, in keeping with the recent Thatcherite privatisation fever, that any step up from the demonstation stage should be wholly funded from industry.

It is hoped that enough interest can be generated by the demonstration to gain financial support from transport industries.

A proposal for a pilot system operating through the Greater London area has already been drawn up and, if investment is forthcoming, the scheme could be operational, with about 300 beacons and 1000 vehicles, by 1990.

It is envisaged that the pilot scheme in London would undergo intense study and development and, once any bugs are ironed out, upgraded into a full commercial system by the mid 90s.

A document giving proposals for the technical standards, implementation, running and financing of the scheme has been put together by the Department of Transport. Collaboration on the document by the West Germans ensures that any systems set up in other European countries will be compotible with the British one.

The cost of the pilot scheme is put at around $20m but the British Transport and Road Research Laboratory estimate that Autoguide could help reduce average journey times by around 10% and reduce mileage by around 6%.

The cost of fitting out a vehicle with dashboard display, processor and sensors should run into about $1000 in a mature market and users would pay some form of subscription fees for use and upkeep of the central control system.

The economic benefits of a London system with 400,000 users would be in the region of $250 million.

At present there is quite a deal of interest from courier companies, fleet owners and private bus, taxi and truck companies. With the Channel Tunnel well under way the potential for a complete European Autoguide network is vast and, by the looks of things, well within the bounds of possibility.

The Sunday driver . . .

While the kids settle down in the back seat you punch in the two digit code for the beach. Out of the driveway and down to the end of the street, through the lights at the intersection and a familiar voice tells you to turn next left. You usually go by the highway but it must be pretty congested today.

This way's a bit longer but your Autoguide obviously thinks it'll be quicker. From up on the ridge road you glance back down at the lines of stationary cars on the highway. They're digging up that road again! You should've guessed. eti

Robert Irwin BE (Elec) is an engineer who freelances in the technical field.

STUART CORNER

ORBITS FOR ALL

World satellite conference hailed successful

The World Administrative Radio Conference on the Use of Geostationary Orbits and the planning of space services utilising it (WARC-ORB 88) in Geneva recently has been hailed as very successful from Australia's point of view. Stuart Corner reports.

Delegates from WARC-ORB 88 have now returned home after representing Australia in one of the most important communications conferences held over recent years.

Lex Vipond of Aussat who was one of ten Australian delegates said the result was "very positive". The allotment plan was able to accommodate all countries. "There is little likelihood that Australia will need to make use of its allotment, but the success of this plan will reduce pressure on other areas.

The five-week conference, organised by the International Telecommmunications Union, was attended by almost 1000 delegates from 120 countries and 15 international organisations. It faced the difficult task of providing equitable and guaranteed access by all countries to geostationary satellite orbits and frequency bands for fixed (point to point) satellite services. Two separate mechanisms had been developed by a previous conference, the Allotment Plan and the Improved Procedures. It was the job of the conference to finalise these.

'. . . a much-needed boost to confidence in the ITU'

Australia's two major areas of concern were getting an allocation that would allow for coverage of, its offshore territories and some definition of the decision-making procedure for assigning future locations and frequencies under the Improved Procedures. Australian observers feared that the method proposed - formal, biannual Multilateral Planning Meetings (MPM) - would be so drawn out as to delay the introduction of new technology and services by several years.

Streamlining

Vipond said the MPM proposal had been "watered down substantially and the result of the conference was a streamlining of some of the areas with the use of MPMs only as last resort if co-ordination was unsuccessful."

The need to cater for Australia's offshore territories had been omitted from Australia's initial input to WARC. Other countries, such as France and the UK had specified as many as 40 associated territories all around the world.

Another potential difficulty for Australia which had been successfully resolved, according to Vipond, was the omission of one half of the 12 Gigahertz bandwidth used by Aussat from frequencies covered by the Improved Procedures. Vipond said careful work by Australian delegates at the conference had ensured that this band would receive the same consideration as the rest of Aussat's frequency allocation. "It could have been a bit of a nightmare if that had not happened," he said.

The conference also allocated frequencies for uplinks to dedicated broadcasting satellites. The orbital allocations and downlink specifications were originally allocated in 1977, but uplinks were omitted from these specifications.

Broadcasting

Another success for Australia was in getting its orbital allocation for a broadcasting satellite (should it ever choose to launch one) changed from 98 degrees east (somewhere over the Indian Ocean) to 120 degrees east (over the Eastern border of WA). John McKendry, first assistant secretary radio com-

Telecom — OTC venture killed off

Telecom and OTC have moved swiftly from co-operation to competition mode in the provision of electronic mail services. They recently announced that their joint venture service, Keylink, was to be disbanded. Less than a month later, before formal dissolution of the combined service, Telecom announced significant enhancements to its independent service, still called Keylink. OTC's service, formerly known as Minerva, will operate under the name Dialcom.

OTC launched Australia's first public electronic mail system, based on the Dialcom software in 1983, Telecom followed with its Telememo service, based on Telemail software in 1985. Difficulties arose when OTC offered its subscribers direct access to the international and domestic telex networks with their own unique telex number. Telecom, and particularly its union, objected to this as it represented a low cost alternative to a dedicated telex line and terminal. The joint venture, formed in 1986 was the result.

There has never been complete integration between the two systems. Subscribers have always had to choose to join either Keylink D (Dialcom) or Keylink T (Telemail) systems. Keylink T had the lion's share of users with 12,000 out of a total of about 15,000.

Competitive

At the announcement of the split bath organisations promised that they would be enhancing their respective services to make them more competitive. OTC said it would be providing a fax interface allowing Dialcom users to send to fax machines, an interface to private electronic mail services via the X.400 standard and an interface to its new Intelnet intelligent database ac-

munication operations branch in the Department of Transport and Communications, explained that the original allocation had been made in the early seventies when technology did not permit satellites to transmit on battery power alone. As peak TV viewing time is in the evenings, it was necessary to locate the satellite where sunlight would activate its solar panels during evening viewing hours.

Subsequent advances in technology have solved this problem, so Australia pressed for a shift in its allocated position. An 8 dB penalty in transmission power would normally be imposed, McKendry said, but this was only necessary in more crowded areas of the world, and the Australian delegation was able to have this penalty waived.

Australia also was given permission to increase uplink power to the Aussat satellite during heavy rainfall. Signals in the Ku band at which Aussat operates are heavily prone to rain attenuation.

The conference also considered allocating frequencies for direct satellite sound broadcasting, but decided to defer decisions on these to the next WARC conference in 1992. It is expected that the frequencies will be in the 1 to 2 GHz range. McKendry said there were "enormous problems" associated with sound broadcasting. The idea is that the signals will be able to be picked up on a small non directional antenna. This will require so much power that it will be impossible to use the allocated frequencies for any other purpose. McKendry said that other services would have to be moved to accommodate sound broadcasting. It's not a proposal developed countries like Australia support, as they are already well served by existing radio transmitters.

'It could have been a bit of a nightmare'

The conference also allocated frequencies on a worldwide basis for high definition television. These will be in the frequency range from 12.7 to 27 GHz.

Multiservice

One area where Australia achieved little progress was in multiservice satellites. There are separate regulations and orbital allocations for satellites providing mobile communications, fixed (point to point) services and broadcasting. Densely populated, highly developed nations tend to have separate satellites for each service, but nations such as Australia and India for reasons of economy, want to combine several services on one satellite as Aussat does. "This makes it particularly difficult to co-ordinate" said McKendry. "People have been avoiding the issue for years."

The regulations come into force on the 16th March, 1990 and are expected to remain valid for at least 20 years. At present there is no perceived need for further revisions to the fixed satellite services plan. Mobile satellite services are another story entirely. The last conference on mobile services was held in 1987, the next one, due in 1992, will "revisit many of the battles fought at the 1987 conference" Vipond said. "There is already a lot of activity from the aviation community and people are girding up their loins for the battle." eti

cess service launched in October. Telecom, however, has been first off the mark with a new user interface, that well advanced in the planning stages even before the split.

Bob Osborn, manager of Keylink, said that Datalink could be programmed to interface with "virtually any other messaging service," however, Doug Scadlock managing director of Cybersoft, said that it would not be offered in Australia for use with the Dialcom system.

Telecom also announced new interfaces between Keylink and other business communications services: Viatel, Telex and fax.

In an exuberant statement of the benefits of Desklink, Osborn, said that the Desklink/Keylink combination "delivered a devastatingly cost-efficient solution for businesses of all sizes. As this new type of service independent interface technology develops the cost imperative will inevitably swing back in favour of electronic messaging," he said.

Desklink, developed by Sydney software house Cybersoft, is an icon driven user interface for Keylink which replaces the often complex series of commands needed to drive Keylink.

Desklink is designed to run on IBM compatible PCs. It provides all the software needed to use Keylink. Desklink will retail for $249, and will be priced at $199 with new Keylink subscriptions for an initial three months period. Australian modem manufacturer Netcomm will also bundle Desklink with its products for at least three months. A Macintosh version of Desklink will be available early in 1989. OTC's manager of enhanced services, David Brawn, said there was a similar product overseas for Dialcom, known as Uplink, but he could not confirm whether it would be made available in Australia.

TECHNOLOGY

New versions of some familiar products demonstrate how fast pc based CAD systems are developing. Tony Pugatchew reports on two superb packages . . .

DESIGN TOOLS DISSECTED

OrCAD shapes up to Autotrax

The printed circuit board or pcb remains the most common, effective and cheap substrate for mounting electronic components. However, designing pcbs is a long and complex task. So it is no surprise that computer assisted schematic capture and printed circuit board design is a welcome and productive aid to electronic engineering.

The extra benefits of design rule checking, gate and pin swapping, automatic placement of components and automatic routing of connections mean that complex boards can be rapidly and reliably produced. These tools are certainly an improvement over the manual taping options.

Over the past year or so, we have reviewed both schematic and PCB design systems from a variety of sources. The main aim of these reviews has been to examine the low priced product range which would be in line with the projects undertaken by small organisations. These packages were different in philosophy from the expensive systems since they did not offer automatic routing, complex design options and auto-placement.

I use the term *were* because the new generation packages are starting to incorporate some of these features. For instance, in this article we review two printed circuit design tools: OrCAD/PCB and Protel/Autotrax that herald a new, smooth and easy-to-learn environment. Both systems include automatic track routing and component placement aids.

Automatic routing

The skills required to produce a board with a low number of connections between the different layers (vias), as well as neat and clean track placement, require practice, patience and some natural ability. A computer permits the designer to place components and then to easily edit the placement and track layout. The manual placement of tracks is a considerable fraction of the design time, so automatic placement is a very useful option.

Computer routing is based on mathematical concepts, such as Lee's algorithm, which define a strategy for placing a track from source to destination through an area that may be littered with other components, vias and previous routes. The auto-router must decide the best way of joining the components with imposed restraints of via minimisation, and the absence of long and convoluted tracks.

The auto-routers can be segregated into groups depending on the predominant algorithms:

★ **Rip up and re-route algorithms:** These continually evaluate their attempts at track placement. They remove traces that block routing paths and place problem traces in areas where space is available.

The inherent complexity of this approach requires long routing times to achieve acceptable completion figures. The high-end systems run on mini-computers. PC based systems sometimes require a co-processor board to finish the job. The algorithm tends to result in an excessive use of vias because it permits any point on the routing grid to be a via, which is then progressively removed.

> ***'The screen management and production of new components is very slick'***

★ **Maze auto-routers** These algorithms start at the signal source and proceed to the destination by moving across the layout, which is assumed to be a maze. The imposed parameters that act as constraints are the number of vias in an intended route and the overall shape of the route. The user restricts the route to be an L Z or C shape, with 1,2, or 3 vias. This constraint is neccessary, otherwise the route can wind itself into a knot. The maze router goes very fast in the initial stages but then slows down as the board fills up. The completion percentage versus time is almost an exponential that asysmptotes to 100 %.

★ **Proximity routers**: These systems draw as much of the interconnections as pos-

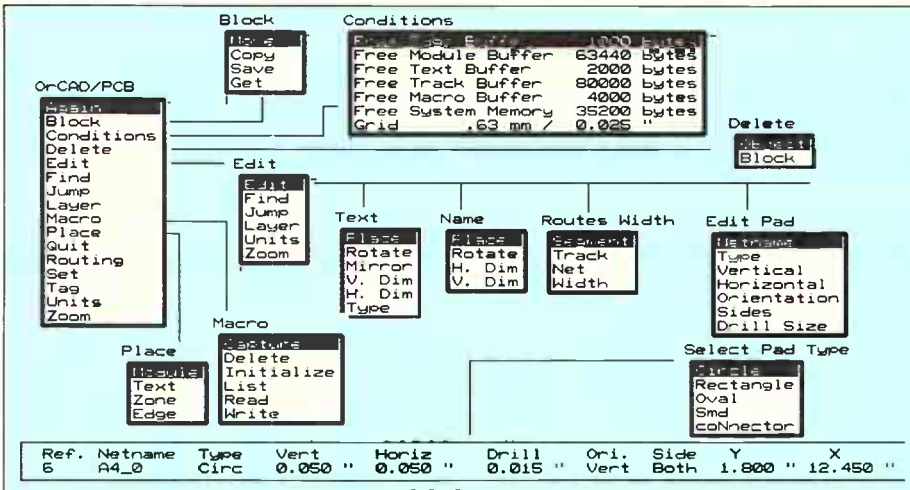

Figure 1: The basic menu structure of OrCAD.

1: OrCAD commands

AGAIN repeats the previous executed main level command. BLOCK and its subcommands enable specific areas to be moved, copied, saved to a file or imported from a file. This is particulrly useful if a section of the board appears in many projects. Selection of the block is performed with the cursor by defining the start and end points of the block. The subcommand has extra options , for example, the BLOCK COPY function requests the user to define a module, tracks, text, zone or all the entities in the block to be copied. The CONDITIONS command displays the state of the computer memory, and the memory available for placing modules, tracks, grid and text. This is an important command since the system is entirely RAM resident. The DELETE command enables the removal of tracks, nets, modules, zones or blocks. A second option returns a sub-menu with choices OBJECT (deletes object under cursor) or BLOCK (permits the drawing of an block outline). This latter option is very useful because the auto-router may be run many times on a particular design and a problem area could develop. Tracks from this section can be deleted en mass rather than ripping up individual tracks. EDIT changes the attributes of pads, names, text and nets. The submenu options depend on the object under the cursor. The PAD submenu is a complex option since it permits changing the netname on a pad, the type of pad (Circle, rectangular or elliptical), the horizontal and vertical size of the pad, its orientation and whether the tracks can connect on the pad from the component side, solder side or on both sides. This is required for surface mount components which may be loaded on both sides of the PCB. If the cursor is over a net when the EDIT command is chosen, PCB displays the ROUTE width menu at the base of the screen. The segment, track, net and width can be changed by moving the cursor or mouse. The values scroll up or down depending on the mouse motion. The NET command changes the width of all tracks in a selected net. The FIND command locates a string of text characters anywhere in the layout and places the cursor at the object containing the string. JUMP moves the cursor to different points of the layout that have been tagged using the TAG command. LAYER specifies the current working layer. The number of layers is set up in the SET command. The MACRO command captures, deletes, lists reads and write macros. Thus repetitive key strokes can be stored as macros. The PLACE command is the main entry point to placing modules and text on the layout, as well as edges and specialised zones. The SET menu changes the working environment of the PCB.The COLOR command displays the ITEM screen . Selection of an item such as RATNEST displays the COLOR screen. The ISOLATION screen serves to change the track to track spacing, track to via spacing which are required for the auto-routing design rules. These can also be set in the initial PCB configuration. The QUIT command is a deceptive command because it permits a fresh start, initialising the board, entry of library creation, starting plots and reports and several other utilities.

sible and then let the user intervene at critical traces that cannot be easily routed.

★ **Hugging Routers:** Existing traces and vias are pushed aside as this router attempts to complete the tracks.

★ **Bus routers:** These systems lay only those nets that have direct source and targets points. No vias are permitted so it is an ideal technique for power and ground tracks.

★ **Strategy routers:** The algorithms that govern the strategy router define a set of rules on track patterns. These rules may stipulate the angles of tracks to pads etc.

★ **Gridless routers:** One of the main constraints of the previous router algorithms is the requirement of working to a grid. The gridless router works to a very fine grid in the order of 0.001 inches and therefore the tracks can be shuffled in the routing of extra dense boards.

Router efficiency

Auto-router systems are being continually upgraded in terms of algorithms, speed and by the incorporation of user defined rules. Products differ considerably in the amount of user intervention they allow. CADStar, by Racal-Redac, has minimal user defined routing options, for instance, compared to P-CAD, where via options, strategies, length of stubs and so on can be defined.

Currently, the big push in router efficiency is to increase board density. Routers now have to contend with small components that sprout connections on all sides of the component.

In this review we look at two low cost PCB systems that incorporate auto-routing and reduce the user learning curve due to excellent design and attention to small details.

OrCAD/PCB

This is the pcb extension to an excellent schematic capture program that was reviewed last year (ETI, January 1988) It is an interactive printed circuit layout system that uses pop up menus and prompts. This mode of presentation is very lucid and most functions can be carried out without reference to the manual. The system permits entry of netlist files created with OrCAD/SDT and manual placement of both components and connections. It is not essential to have an input netlist since nets can be allocated after component placement.

The comprehensive parts library includes surface mount components, connectors and all the standard parts. Extra parts which are referred to as modules are easily created.

The auto-routing option is based on a strategy router on selected layer pairs. Power and ground rails can be routed with a bus routing option. The commands are grouped into main and sub-menu commands that can be selected with a mouse, key board or by typing the first letter of the command. Box 1 shows the command menu, some of the lower order screens, together with an explaination of the commands.

OrCAD/PCB uses a complex web of subcommands and options. It is useful to briefly highlight some important functions: component placement, loading netlists, component creation and auto-routing.

Components, modules or parts are loaded with the PLACE - MODULE sequence with modules being loaded from the subdirectory specified in the initial set up screen. The PCB then requires a file name for the part. Once the part is loaded its netnames and module designator have to be edited by invoking suitable subcommands of the EDIT command.

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HGA5 ... ULTRA HI GAIN AMPLIFIER
BD1 ... BUG DETECTOR
FCT5 ... FM BROADCAST TRANSMITTER
RWM3 .. RADIO REPEATER TRANSMITTER
VS10 ... VOICE SCRAMBLER
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OrCAD shapes up to Autotrax

The optimum placement of components is assisted by showing the netlist and the force vector which represents the modules centre of gravity and the wires connected to that module. The longer the line protruding from the component the longer the average wire length that has to be routed from that module. The direction of the vector from the centre indicates the direction in which to move the module to shorten the average wire length. The designers aim is to remove the areas of high track density and, if possible, to produce an even distribution.

The auto-router is a useful tool in the placement phase (See box 2). If the auto-router can only achieve a low routing success then the placement may be sub-optimum which will be illuminated by areas of unconnected nets. These components can be juggled to achieve a higher routing success. Tracks can be easily moved, placement altered and the process repeated. It is obvious that the large number of routing options may make it difficult to decide the best choice. (See box 3).

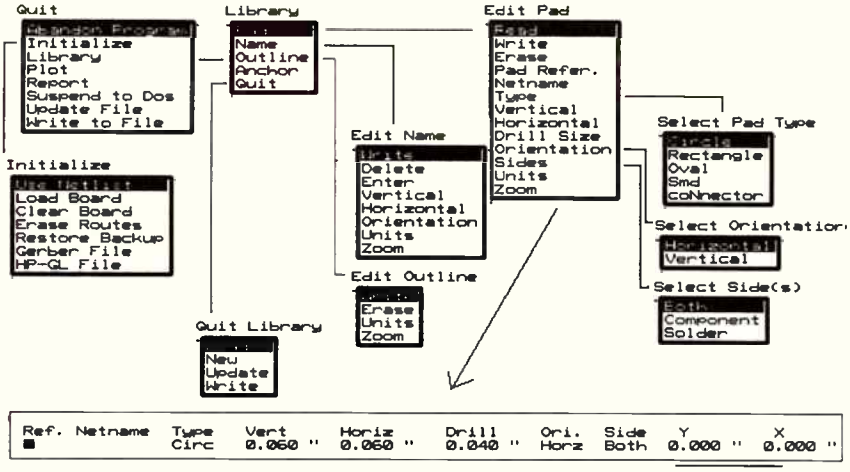


Figure 4: Manipulating the library in OrCAD PCB.

A few examples will illustrate that the NORMAL option is ideal for memory and repetitive connections whereas EXTENSIVE is suitable for most of the other connections. The 90 degree choice produces a very disciplined layout. The important feature of the OrCAD/PCB system is that sections of the board can be routed with differnet strategies and routing grids (using the BLOCK routing or MODULE options). Experience and a quick auto-route of the whole board will illustrate an efficient strategy.

Component creation is an important requirement of PCB design systems since new and possibly non-standard parts must be created by the designer. OrCAD/PCB performs this function by algorithm. The COMPILE option reads the layout into an internal format.

Several extra commands are very useful in this routing mode. The CLEAN UP command erases tracks that do not end on a track or pad.

The AUTO-ROUTING selection brings up a menu with many choices. The PAD command automatically routes the netconnected to selected pods. MODULE is a very useful command which automatically routes all the nets to the originating on the selected module. The NET command completes the net associated with selected tracks. The BLOCK option routes the tracks inside a defined block. All the tracks can be routed with the ALL command. The strategy command prompts for a strategy file for the autorouter. The strategies are as follows. NORMAL, which discourages 45 degree connections to tracks and forbids them entirely on pads. The FLEXIBLE strategy removes the 45-degree restriction on pads. The EXTENSIVE strategy permits 45 degree connections anywhere on the board. The POWER strategy allows connections to existing tracks. The 90 DEGREE strategy allows only 90 degree angle turns and to a single side. Individual tracks can be removed with the RIP UP options and re-routed.

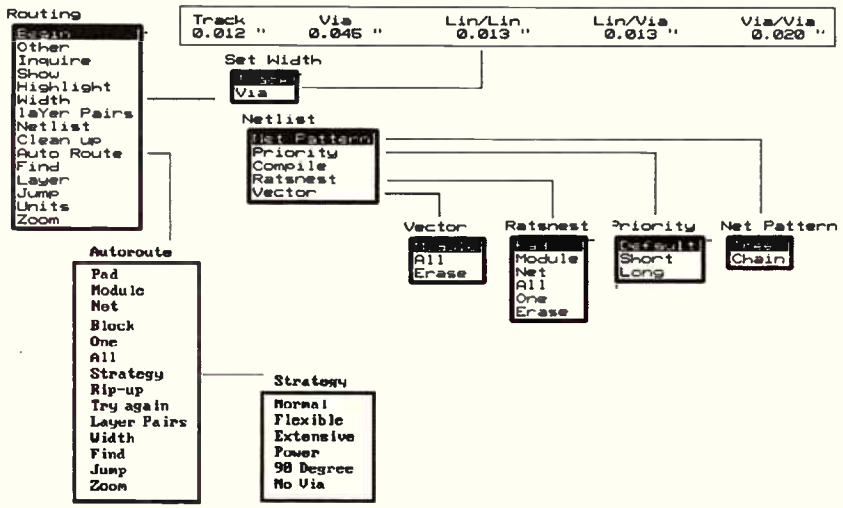
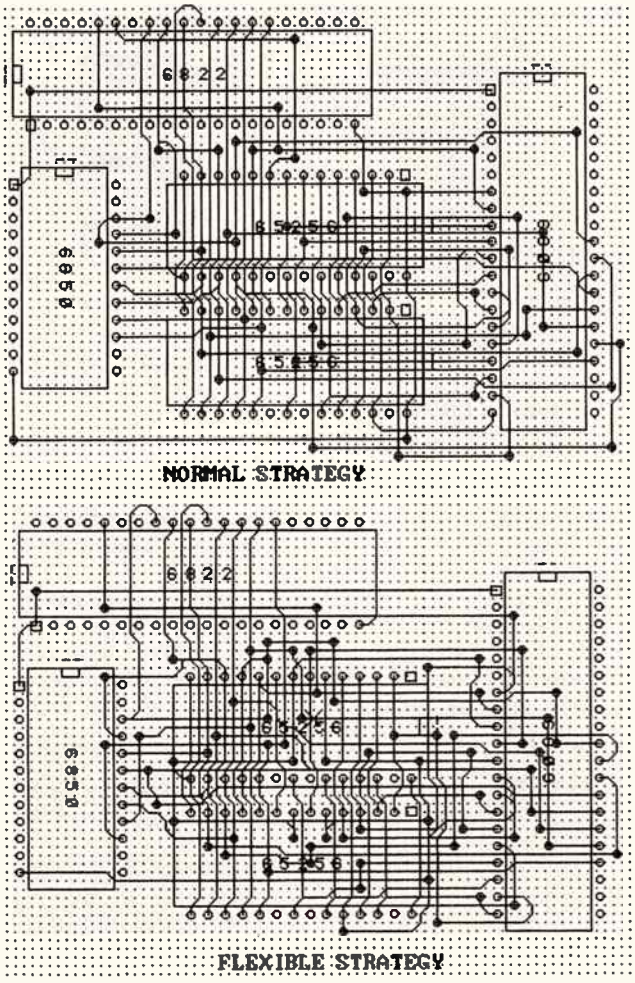


Figure 2: The menu structure for routing tracks in OrCAD.

2: Placing tracks with OrCAD

The ORCAD/PCB system permits both manual and automatic placement of tracks. The ROUTING menu contains the commands that control both automatic and manual routing. The progression of screens is shown in Figure 2. The BEGIN command draws a track on the current working layer which is indicated by the track colour and the colour of the outline box on the screen. Vias are automatically inserted when the layer is changed by pressing 'O' on the keyboard.

A ratsnest connection is drawn to show the track destination and moves along with the cursor. This is an excellent and easy method of ensuring that the tracks are routed correctly. Since the ratsnest plays an important role in both manual and autorouting, OrCAD/PCB has a NET PATTERN command to manipulate the nests. NETLIST has the following options: NET PATTERN, PRIORITY, COMPILE, RATSNEST and VECTOR. The NET PATTERN selects a tree or chain arrangement for the nest, PRIORITY determines whether long, short or default order for track routing. This uses the PCB's internal



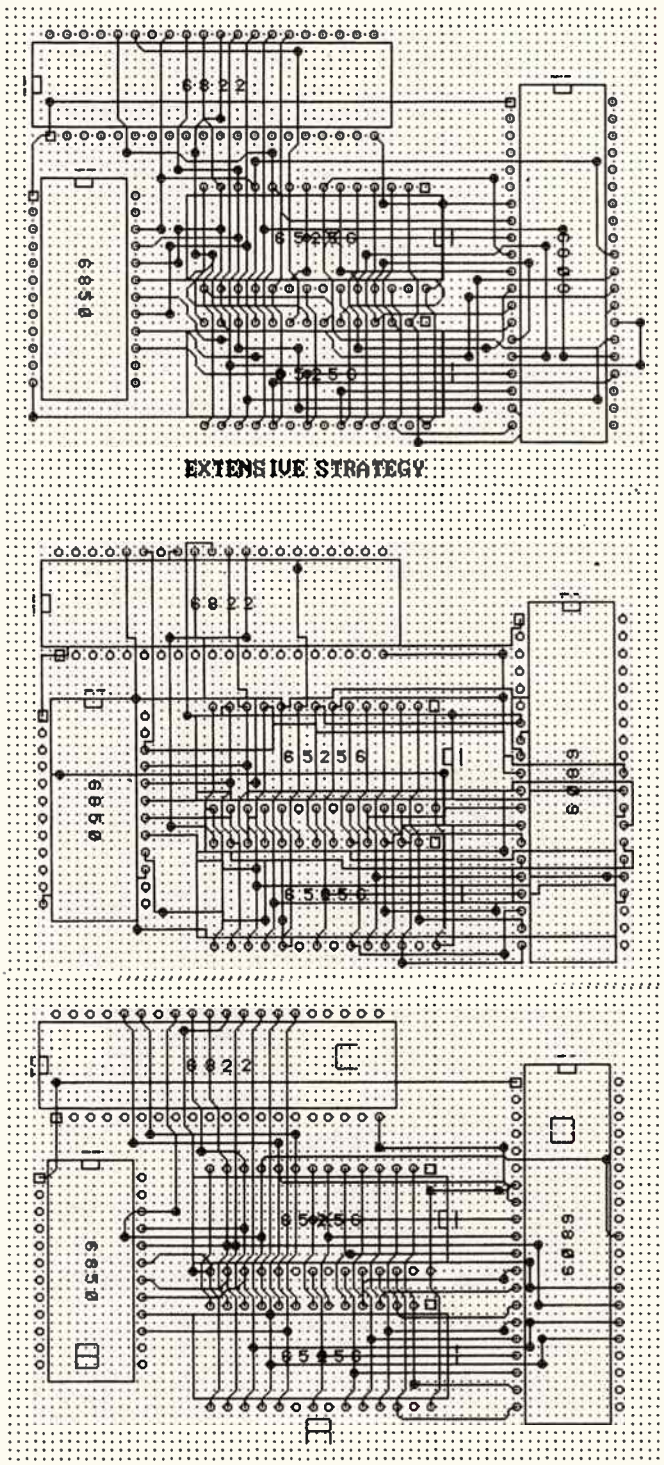


Figure 3: Exomples of outorouting with OrCAD. Different potterns ore obtoined by chonging the routing constroints.

3: Examples of OrCAD/PCB designs

To see the auto-route strategies in action we set up a simple demonstration with a microprocessor, peripheral interface, UART,ROM and RAM. The netlist only specified the 8 data and 16 address lines. The components were placed in such a position to encourage horizontal tracks to merge with vertical tracks in the memory section.

The placement was not optimised but served to push some of the strategies. In Figure 3a,3b,3c, and 3d we show the normal, flexible, extensive and 90 degree strategy plots. The strategies produced nearly 50 vias in this small layout with a routing grid of 0.050 inches. A more intelligent attempt is shown in Figure 3e where the memory block was routed first with the normal option then followed by section B and C with the flexible strategy. A,B and C were routed at 0.050 inch grid. Lastly, the section C was routed at a 0.025 routing grid This results in a more consistent layout.

moving into the QUIT option from the MAIN menu. The function of the sucessive screens is self-explanatory and shown in Figure 4. The lower status screen shows the pad type, size and drill dimensions when the basic pad building block is used.

Summary

OrCAD/PCB is the first low cost system that shows the benefit of integration all the PCB layout functions into one system. The previous systems required layout to be performed with the PCB editor followed by the auto-router.

OrCAD/PCB has many new and novel features such as the allocation of track widths to particular net types, inbuilt plotting function and the ability to manually rip up tracks. However, some improvement can be suggested. The manual has the information littered through many sections and is not in the same class as the schematic editor which has excellent tutorials and examples. The placement of all the components in a stack should be refined and some placement algorithms built in.

The screen management and production of new components is very slick. The auto-router options such as routing all the tracks from a module or in a block are very useful, since, in boards using SMD, severe bottlenecks may occur if the user cannot run the problem tracks initially.

Above all, the displayed examples show that useful layouts can be quicky produced, and the problem areas can be easily rectified with manual editing. The auto-router option serves as a good check of the placement which is assisted with the netlist and vector display.

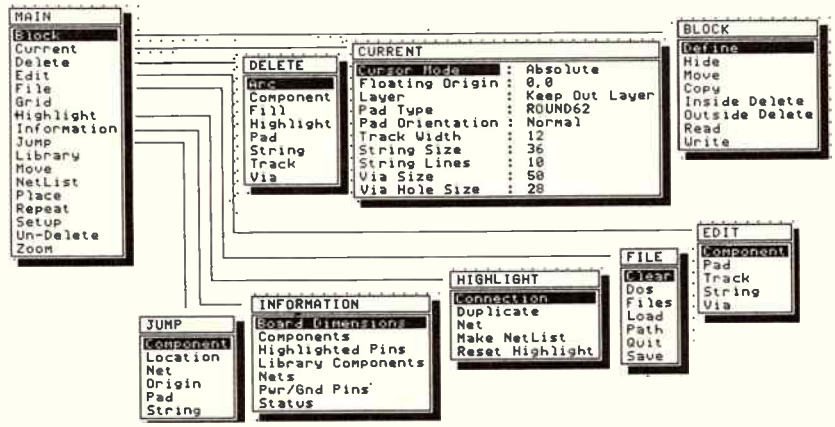


Figure 5:

Protel Autotrax

This system is the result of several iterations in the PCB design area which were started by HST in Tasmania and are

4: Protel menus

CURRENT displays the system trackpad, via sizes and relevant default settings. The EDIT operation permits changes to cursor selected features. For example, text can be increased in size, or the track width of a selected track can be increased. The HIGHLIGHT function serves to define a particular net or produce a netlist from a board that has the tracks placed manually.

In figure 6 we show the task of the other main menu commands. Some innovative effort has been used. For example, the LIBRARY command can LIST the components in the current library . The cursor can be moved to the desired component and placed on the work area with the PLACE command. The LIBRARY BROWSE option selectively displays components on the screen and the contents can be scrolled backwards and forwards.

The PLACE command prompts the user for placement of ARCS, COMPONENTS, EXTERNAL PLANES, FILLED areas, PADS, STRINGS, TRACKS or VIAS. The component option opens an input window requesting the name of the component which can be entered or the component list can be shown by pressing the enter key or the left key of the mouse. The selection bar can be moved to the appropriate component and selected with enter. Next the component identification is requested which must be the same as on the netlist (if the netlist is going to be used).

Selection of the REPEAT command can place the component, track, pad or via a number of times at incremental positions. This operation is useful in the case of memory arrays. Components can also be placed on the board from the netlist bif the part reference such as a 24 pin IC footprint information is present. This is automatically performed with Protel-Schematic file. Other systems have different methods of defining the part reference. ORCAD/SDT does this with the FIELD ATTRIBUTES which are invoked with the EDIT command.

The NETLIST command has an autoplace option which places the components from a netlist in a defined area of the board. Some attention is given to the physical connections but this cannot be construed as a true auto-placement tool.

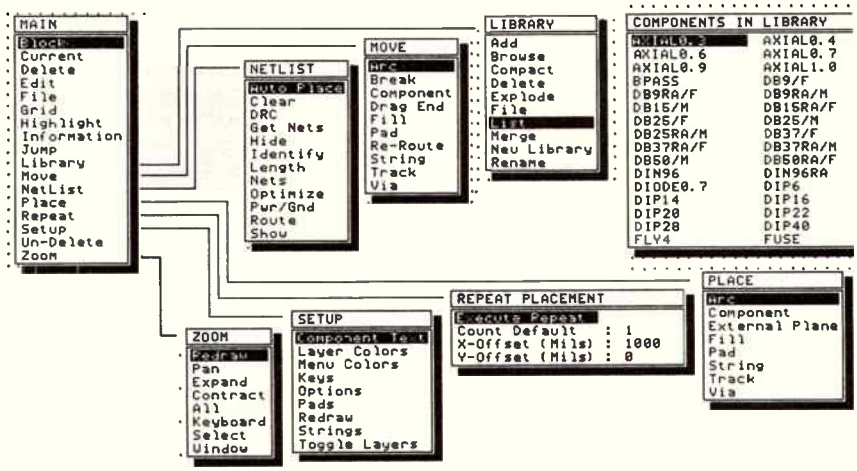


Figure 6: The bosic menu structure of Protel Autotrox

being continued by Protel Technologies. Protel PCB and Protel schematic packages have already been reviewed in this journal (ETI January 1988) The design team have united the auto-routing system (Protel-Route) into an all singing and dancing version called Protel Autotrax. This is a completely new system with a smooth and professional feel in every feature. The manual has good tutorial sections and all the command functions are dealt in a clear and lucid manner.

The system uses pop-up windows with menus and subcommands that have been grouped into similar PCB functions such as block, library and routing operations. Autotrax permits the use of macros and design checking on the completed PCBS. Utilities for plotting on plotters, matrix and laser printers and conversion of Protel-PCB version 3.0 files are supplied.

After the system is installed, and the protection key connected to the parallel port, the user is presented with a gridded blank work surface. The operation menu is selected with the keyboard or mouse and the user can scroll through the options or type the first letter of the desired function. The inter-linked screens are shown in Figure 5.

Track placement

Tracks can be manually placed. When the working layers are changed vias are inserted automatically. The vias appear on all layers or only on selected pairs depending on setup options. Buried or hidden vias can be incorporated on mutilayer boards. A netlist can be generated from a manually tracked PCB with the HIGHLIGHT - MAKE NETLIST sequence. Nets cannot be entered manually.

The auto-routing feature uses a set of maze algorithms and is selected in the NETLIST menu which then drops into the ROUTE window. The sequence is illustrated in Figure 7. The auto-route option selects the BOARD (all routes on board), MANUAL (manual placement), NET (routes a named net) and PAD TO PAD (user selects start and end pad). The MANUAL option displays the connection highlight and the cursor is tied to the highlight to ensure that the track is connected to the correct pads. Other screens enter the routing grid, track separation and the router passes.

The maze router options are selected from the ROUTER SETUP sequence and define the router passes according to the number of vias and overall track shape. If no vias are desired on a two layer board then a small number of routes are completed. The orthagonal rules prohibit direction changing.

The status line on the lower part of the screen illustrates the cumulative routing time, the routing pass, and percentage of completed nets. The router can be interrupted at any stage and restarted with new options as grid size.

Component creation

The PLACE command places pads in the part definition position after the apthe SETUP-PADS-NEW sequence. Tracks on the top component overlay are placed as well as arcs to show the part outline. EDIT-PAD then is used to assign a pin designator for each pad. This is required for the connection of nets from the schematic. The part is then chosen to be a block with the block reference defining the component insertion and rotation point. The LIBRARY ADD command adds the part to the library after requesting the new component name.

Library management allows an existing component to be modified by exploding it and then editing appropriate features. No editing can be performed on a part unless this is performed.

Summary of Autotrax

It is very difficult to do justice on Autosuch a short exposure. The designers have spent a considerable time looking at system ergonomics since we had no difficulty in getting started without too much reference to the manual. The lack of severe bugs which could make the system inoperable indicates attention to all details.

The track placement, automatic panning (which can be turned off), placement of components in a neat array really speed up the design process and make the system very easy to use. The menu system also contributes to this ease. The auto-router produces reasonable attempts, particularly on boards that are intelligently loaded.

Some problems such as double entry on existing tracks are present but the excellent editing facility, which permits tracks and vias to be moved together, can quickly correct these faults. The important ability to auto-route individual nets mean that problem routes should be routed first.

How the systems shape up

Both systems should be commended on their foresight in attacking the PCB area with features that are not present in some of the higher priced competitors. For example, the library browse command is absent from Racal-Redac's CADStar and P-CAD.

Auto-routing of selected components is a very useful feature of OrCAD/PCB, particularly for dense surface mount components. It is a good bet that the auto-routed tracks will have less chance of interference in this strategy. A similar option can be performed in Autotrax by naming these nets and routing individually although the most useful technique is to route these manually.

The allocation of different track widths to certain net classes in OrCAD/-PCB and the unprotected plotting feature of Autotrax are useful for a variety of reasons. Power supplies and grounds would always be routed as thick tracks in the first case and plots on many machines could be undertaken with the second feature.

With reference to the auto-routed examples it is difficult to assign a preference although the extensive strategy of

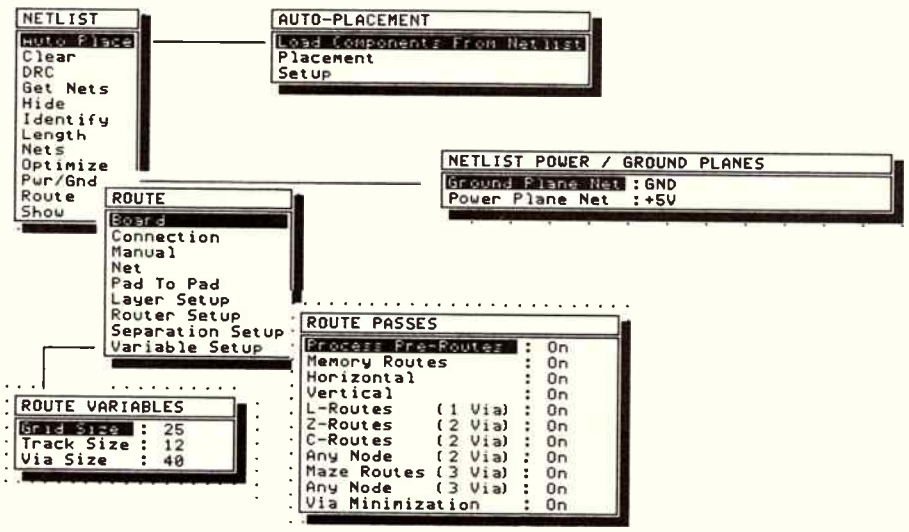


Figure 7: The menu structure for track routing in Autotrax.

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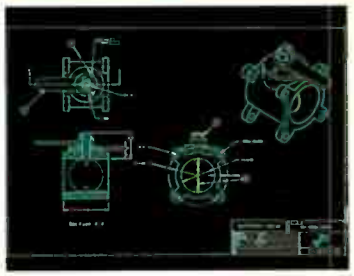

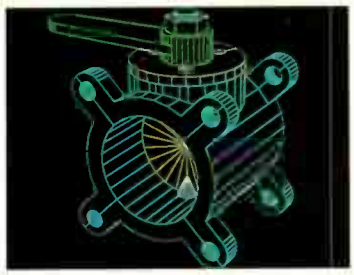

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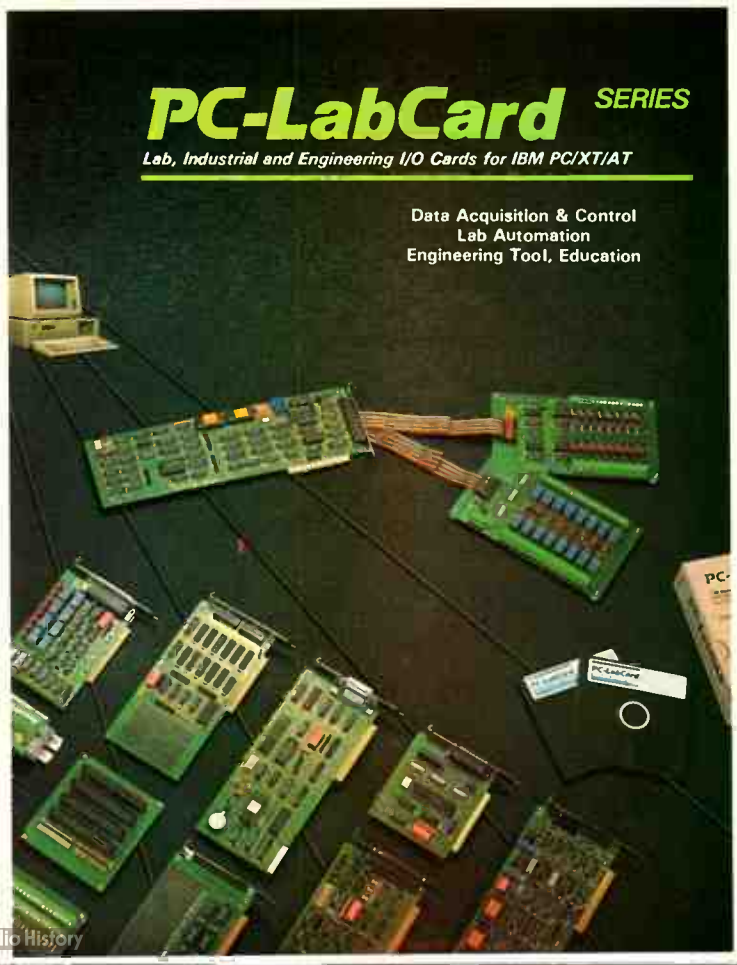

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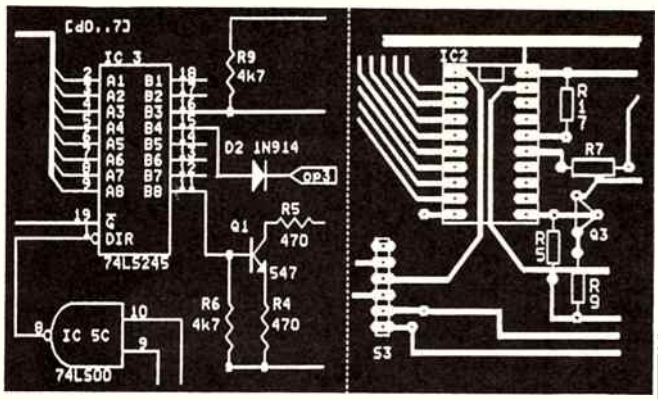

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READER INFO No. 16

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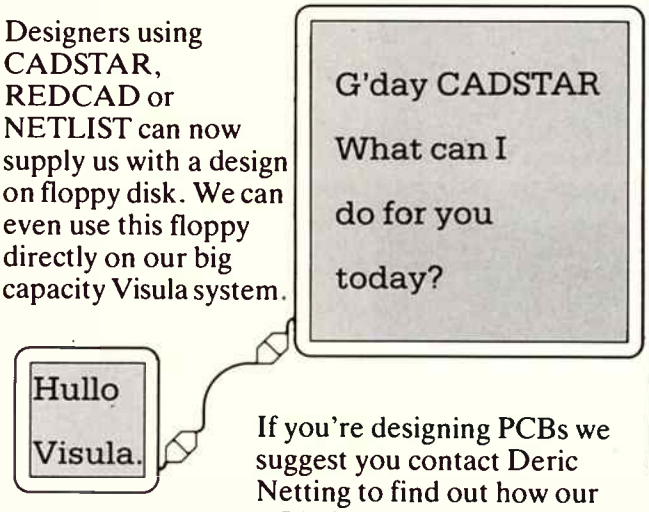

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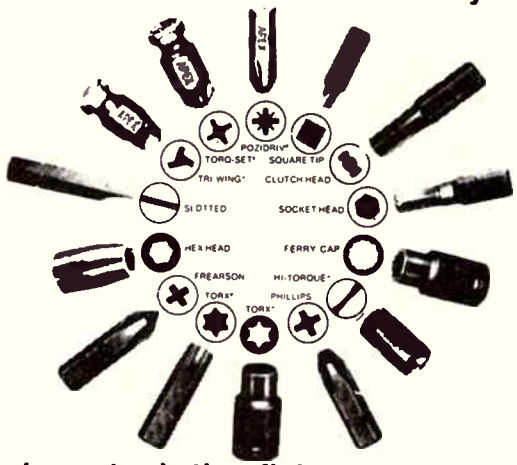

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READER INFO No. 18

OrCAD shapes up to Autotrax

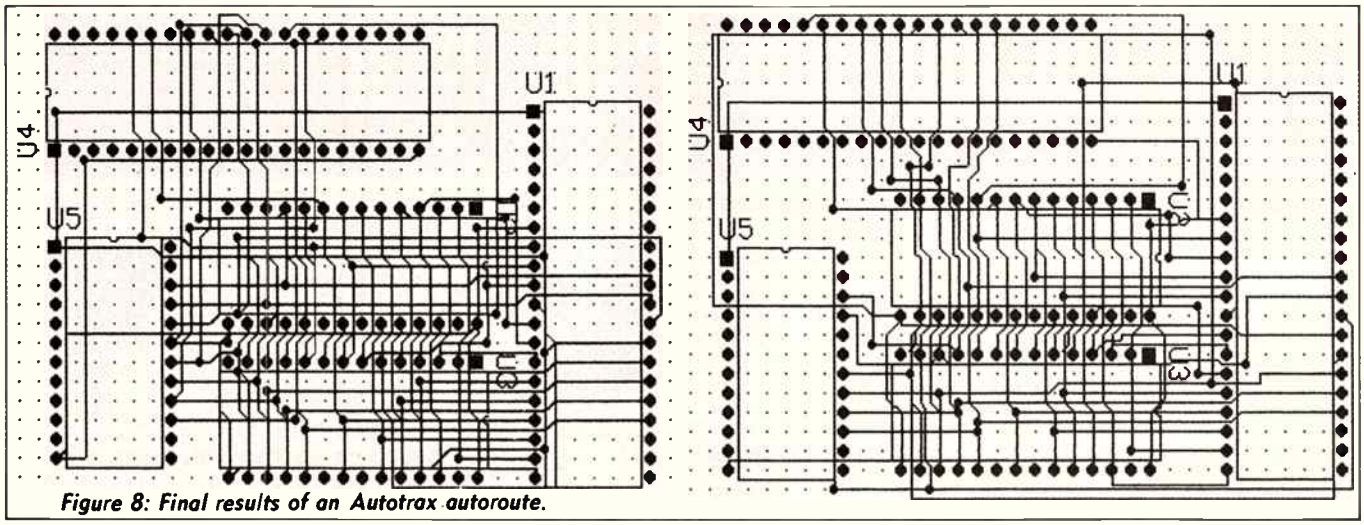


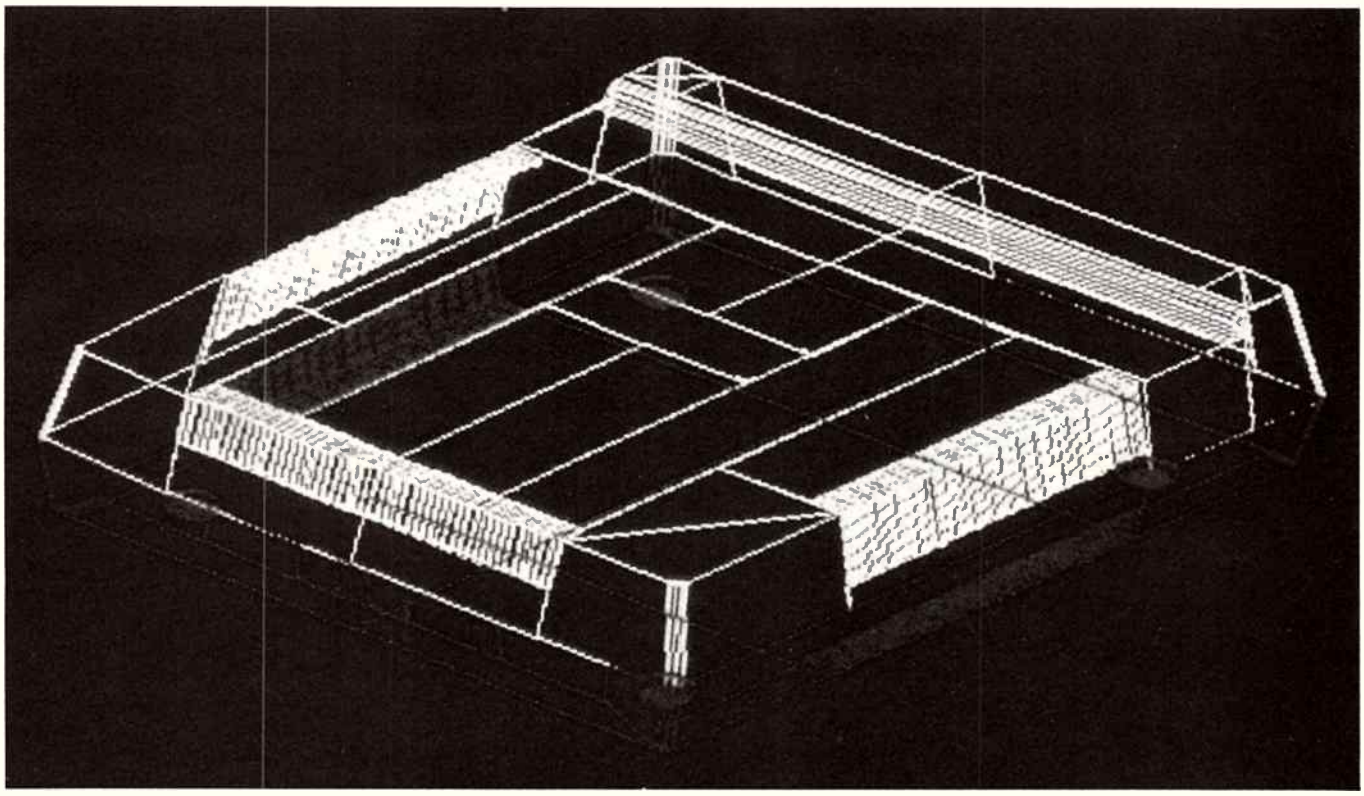
Figure 8: Final results of an Autotrax autoroute.

OrCAD/PCB produced a cleaner layout. The routing time is faster than Autotrax. On the other hand, the maze routing in Autotrax can produce a very low number of routes if certain options are desired. OrCAD/PCB will route more tracks on a single side or no via options for example.

The lower cost of Autotrax, easier component creation, extensive plotting options, excellent manual and good local support, are major pluses for this product from the Apple Isle. Tasmania may be left off inadvertently from some maps of Australia but the PCB product deserves recognition.

As always, users interested in these systems should contact the suppliers and obtain a demonstration disk. Some functions may be irritating to some users and only a trial can illustrate this.

ACKNOWLEDGEMENTS: I would like to thank Patrick Yii from Prometheus Software for evaluation of the many versions of OrCAD/PCB and OrCAD/SDT in order to create schematics for entry into all the PCB systems. Mr. John Powell from Protel Technology deserves thanks for getting the Protel-Autotrax to me quickly after release. The very important plotting and hardcopy consumables were provided by the excellent staff: Barry Liston, Chris Hall, Lisa Smith of ASSCO Adelaide.



The launch of AutoCAD Release 10 is bound to create strong interest in design and draughting circles.

ON LINE DESIGN

AutoCAD Release 10

AutoCAD, a product of Autodesk in the US, lays claim to over 170,000 registered sites of desk top publishing and work stations.

Release 10 is equipped with a host of new features which will provide flexibility and versatility for users of computer aided design systems.

Autodesk designed Release 10 to be totally compatible with earlier versions.

Organisations who acquire Release 10 can do so knowing there is minimal educational training required for both existing and new users.

The highlight of Release 10 is the ability to create and edit all AudoCad entities in any 3-D orientation.

Release 10 has improved in three major areas — drawing and editing, display and new drawing entities.

Visual feedback

The improved features of drawing and editing are the user defined co-ordinate systems which offer ease of use in working on 3-D designs and the new Co-ordinate System Icon feature that provides visual feedback for orientation purposes.

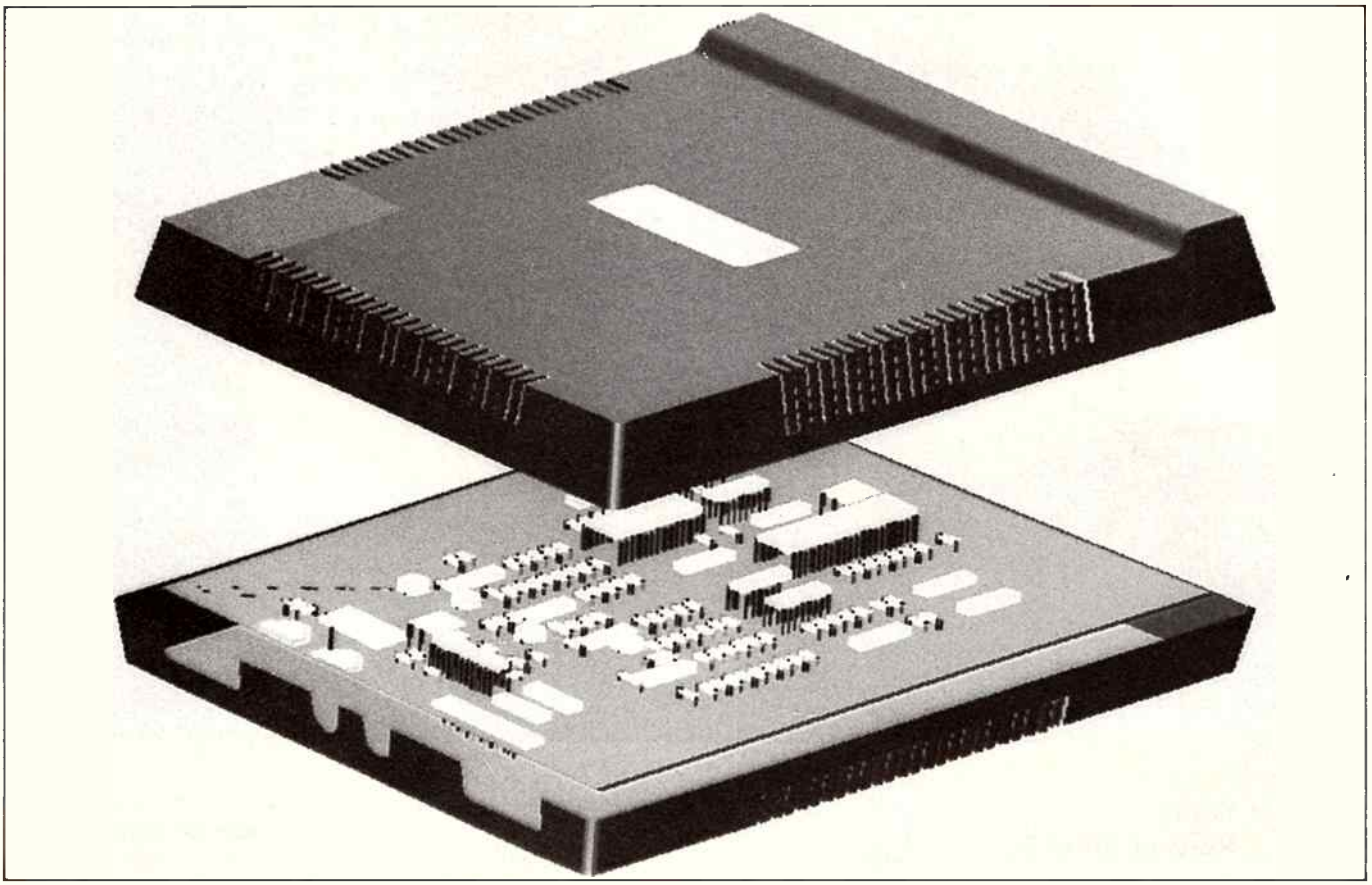
The display features incorporate Dynamic Viewing commands which offer real-time, interactive display specifications. Multiple-on screen views of the 3-D designs is now achievable with the new viewpoint facility.

> *'. . . construction of objects using polylines in 3-D space'*

A new 3-D polyline and five new types of 3-D surfaces complete Release 10's list of drawing entities.

The display features included in Release 10 are:

★ Dynamic Viewpoint
★ Dynamic Zoom
★ Dynamic Pan



★ Dynamic Clipping
★ Perspective Projection
★ Selective Hidden Line Removal
★ Viewpoints

The prime feature of the new drawing entities is the 3-D Polyline which allows the construction of objects using polylines in 3-D space.

The five new 3-D surfaces include: 3-D surface patch; surface of revolution; tabulated cylinders; ruled surfaces and coons surfaces.

Linked information

Another new feature in drawing entities is the unique entity handles. Each entity in the AutoCAD database has a numeric identifier which enables information to be linked to external database information.

The product was released on the Australian market in November. For further information contact Autodesk Australia , 9 Clifton Street, Richmond, Vic. 3121, ☎ (03) 429-9888. eti

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Hardware requirements IBM PC/XT/AT/PS2 or compatibles with 640K RAM, 2 floppy drisk drives or 1 floppy plus hard disk. PC or MS-DOS version 2.0 or greater. Also supports 4Mb EMS.

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• MONDAY, SEPTEMBER 11 – FRIDAY, SEPTEMBER 15, 1989 •

READER INFO No. 25

Alta Mira announcer Steve Davis at a studio console.

A STATION ON HOLD

Languishing for a licence

Getting a radio station on-air has never been easy, especially for groups without influence in Canberra. Angie Testa reports on how planning blunders 20 years ago are affecting one group today.

In 1974 a group of radio enthusiasts with a common goal met in Adelaide. They wanted to start a Christian broadcasting service.

The time seemed right, since the government was rapidly expanding the number of licenced radio stations, so there were great expectations for a speedy realisation of their dreams.

In any event, they were mistaken.

Fifteen years later, there is still little to show for all their efforts. The reason is not so much bloody-minded bureaucrats as planning disasters dating back to the 50s.

Band 2, internationally reserved for FM broadcasting, is occupied in Adelaide, as in many other places in Australia, by TV. The result: The Australian Broadcasting Tribunal turned down their application for a Special or 'S' category licence.

Meanwhile, in other states, various Christian groups were applying for and receiving licences. There was Hobart's 7HFC-FM, Perth's 6SON-FM, Sydney's 2CBA-FM and others on the Gold Coast, Melbourne, Launceston and up at Rockhampton. At the present time there are six.

After the failure to obtain the licence the various members of the Adelaide group worked hard putting together equipment and building up the station, giving their time and effort without monetary gain. Often the cost of equipment came out of their own pockets.

One of their members was John Hackworth, a radio engineer by profession. He acted as their technical man, building and maintaining all the equipment. He also built the radio link to carry the signal out of the studio to the transmitter. Their mobile studio was housed in a caravan.

In December 1979 they conducted their first test broadcast from Belair. It consisted entirely of taped programs. A second broadcast followed in April 1981 from Mt Lofty and a third in April 1982, again from Belair, this time at 50 watts — the two previous had been at 10 watts.

The test broadcasts were designed to test the operation — every facet of it from the technical to the various on-air personalities involved. The group had to demonstrate to the Department of Transport and Communications, now in charge of distributing licences, they were capable of broadcasting.

Register

Meanwhile the Department advised that it was establishing a Planning Register and requested that a PS1 'Expression of Interest' be submitted. This was done.

At the same time the station itself was making plans. In October, 1983 a new constitution was adopted and the association was registered under the name of Christian Community Radio Inc. (the name Alta Mira was adopted later as a means of communication, from two Latin words meaning 'high and lifted up' and 'miracle or wonder'). They appointed Deane Williams as their Director. It was a sound choice.

Deane Williams had a background in broadcasting, having worked in various aspects of radio and television. He had begun his working life in 1963 and spent the first five years at Channel 9 in Adelaide where he came up through the production ranks and was involved also in photography and film production work. He left Channel 9 and spent five years working in a family business but was back in radio in 1974 serving on radio 5AU at Whyalla/Port Augusta as an announcer for two years. In 1976 he joined BKN7 at Broken Hill where he managed the station and then it was back to Adelaide a year later where he became Facilities Manager at Channel 7 for seven years. He left that job in October 1983 to become Director of Radio Alta Mira — a big step of faith as Radio Alta Mira were no nearer to getting their licence. They did some broadcasting however, by purchasing air time on other stations.

In September 1985 the group conducted a further test broadcast, this time from the Wayville Showgrounds during the Adelaide Show with a 100 W transmitter at Belair. A further broadcast in the December of that year from Belair was at 250 watts.

In April 1986 at the suggestion of the Station Planning Branch of the Department of Transport and Communications, an expression of interest for a 'C' category licence was lodged, while still maintaining the expression of interest in the 'S' licence to serve the wider metropolitan area. Later interest in the 'C' category licence was dropped.

Feedback

A sixth test broadcast, again from the Royal Show at Wayville, was conducted in September 1986 at 250 watts. The presenters of the programs and the

Deane Williams.

others who worked on the broadcast took six weeks leave from their jobs to prepare for the week-long series of programs.

The results were to prove a worthwhile investment of time. Asked over the air for feedback from anyone listening, the station was swamped by an amazing two and a half thousand phone calls and around five hundred letters all pledging their enthusiastic support!

Ongoing problem

The problem for Adelaide, however, is an historical one. Band II was originally selected for TV use in Australia because planners in the 1950s believed FM radio would never be required here. The subsequent explosion of FM radio world wide has made Band II spectrum space extremely valuable.

Since 1985, the government has had a policy of moving TV transmitters into the UHF, out of Band II. However, Band II clearance is an ongoing problem not likely to be resolved in the short term. TV owners are reluctant to move to UHF because of the cost involved.

In Adelaide Band II is occupied by GTS 4 and 5 television stations. The government have said that the station will be taken off the VHF band and moved to UHF by 1989. When this has taken place licenses on the FM band can be applied for by public radio stations, and Radio Alta Mira, it is hoped, will be granted one at this time. However, there may be many applications and only a certain number of licences can be granted.

Another aspect of Radio Alta Mira's success is to do with sponsorship. It is not to be conducted as a commercial radio station. Funding is by membership of the station, donations and sponsorship. Their current aim is to build up their membership to a figure of 6,000 in the period before full-time broadcasting can be a reality.

In this respect they have the support of the Churches of Adelaide. On Friday 1st July the Heads of Churches Committee agreed to support Radio Alta Mira's request for a broadcast licence. They have agreed to each provide a letter of endorsement supporting the request for a licence and also approach the Minister of Transport and Communications with the same request. With so much support it will at least illustrate the need for a Christian radio station in Adelaide.

There has also been released a 'National Plan for Development' which was approved recently by Cabinet. It mentions "the need to respond to persistent suggestions that there should be a place found within the commercial radio system — which is well equipped to accommodate diversity — for special interest radio services (eg: Ethnic, Racing, religious. . .) as well as many other issues.

There are strong indications that the Department of Transport and Communications will be prepared to receive Radio Alta Mira's "planning proposal" in the very near future. This planning proposal is normally submitted by invitation.

There has also been another significant change in that Gareth Evans has been moved from his role of Minister for Transport and Communications and is replaced by Ralph Willis, in the wake of Bill Hayden's resignation from his post of Foreign Minister to become Governor General.

Angie Testa is a freelance journalist closely associated with Radio Alta Mira.

PAUL BUDDE

ATUG DISTINCTION BLURRED

Immediate transition sought

Videotex roundsman Paul Budde reports on the battle to marry communications to the available computer equipment and provides an overview of the videotex world at large.

The Australian Telecommunications Users Group (ATUG) has called for an immediate transition to a "policy which applies equally to communications and computer equipment". In the medium to long-term, however, the distinction will become so blurred as to be not discernible, according to ATUG.

"The IDA must ensure that the users' needs in the marketplace are met by ensuring that a range of equipment and services is available with features, specifications and quality of an international standard." ATUG suggested that the present Telecom administered arrangements could continue for another 18 months to allow suppliers time to migrate to the "new more flexible and industry-friendly arrangements".

The Australian Electrical and Electronic Manufacturers Association (AEEMA) submission claims that rigorous application of the corporate citizenship scheme is "neither acceptable nor appropriate in the Customer Premises Equipment (CPE) industry".

It suggested that approval to supply should be granted on the basis of a commitment to achieve, within five years: Australian R&D equal to 5 per cent of turnover; total exparts of CPE equipment equal to 50 per cent of imports by that supplier and expenditure on supparting infrastructure such as administration, logistics, support, training to be 8 per cent of turnover from sales of CPE.

Work carried out by approved subcontractors would be included in these assessments, AEEMA suggests.

It also suggests a moratorium until July 1990 on the approval of any new cellular mobile telephone suppliers, and that those companies selling only CMTs at present be barred from entering the other CPE markets during the period.

Home use

The following table is an indication of the popularity of Teletext in European households:

Country	x 1,000
Switzerland	620
The Netherlands	600
Sweden	350
Austria	300
Belgium	270
Norway	170
Denmark	145
France	100

Interlinking

In the past two years, the on-line market has seen some important changes. Until recently, on-line services could only be accessed by highly trained librarians. With the PC emerging in the office, governmental, scientific, bibliographic and business data bases become more in demand. Despite this search, structure on the on-line services is still very user unfriendly and in the past two years, no new developments took place to change this.

UK mail to Viatel

Epinex, the videotex service launched by Timefame in the UK has now added an electronic mail connection to Viatel, the Australian Telecom-run videotex service. UK users pay 50p a message. Epinex uses British Telecom as well as Mercury lines for its service, which now has about 80 IPs (Thompson, Sky Tours, Harrods, Airtex, etc). Roy Norman, director, would disclose neither number of users nor network traffic.

USA videotex revenue

Revenues from videotex services in the USA will grow from US$75 million in 1985 to US$170 million 1990 according to the USA Department of Commerce. There are some 800,000 videotex subscribers in the USA, growing by 15% per annum in the business market and 12% in the domestic markets.

In countries outside the USA the annual growth in videotex is 40-50%. By 1992 the world revenue in videotex services will be between US$12 and US$18 million. On-line data bases in the USA will grow by 18.5% to US$3.2 billion by the end of this year. This growth will continue over the next five years. 25,000 Americans have jobs in the business of on-line publishing.

One fifth of the revenue comes from overseas users mainly in Germany, Canada, the UK, Japan and France. The major growth market now is in CD-ROM.

Govern-tex

Nearly US$1 billion worth of videotex-type systems will be sold to federal, state and local USA government agencies between 1988 and 1992, according to a new Frost & Sullivan study.

The 206-page report concludes that market growth will depend "on vastly im-

Playboy on-line

Playboy has started an electronic service for users of the Source service in the US. Playmate pictures, cartoons and advertisements are the first applications, initially for Apple users only. If the service is successful, IBM software will also be made available.

France and Finland link

The Finnish PTT and Intelmatique, the export subsidiary of the French Telecom, have agreed to interconnect their VDX-100 and Minitel videotex services to enable business users to access the services offered in both countries. The interconnection, based on X.25 and X.29 protocols, will operate on the packet data networks, routed via the Datapac and Transpac data networks. Pekka Tarjanne, director general of the Finnish PTT, believes "in 10 years, there will be a difference in the economic health of countries which make a serious commitment to videotex for consumers and business. That is one reason Finland is offering the Minitel connection."

proved marketing and sales strategies" of major system vendors. *The USA Market for Government Videotex Systems* analyses and forecasts the size of the market for sales of related technologies (particularly optical disks) and evaluates the economics within government agencies for the purchase of computer systems.

Alex for Canada

Bell Canada has announced Minitel plans for its home country. A trial service of its Alex terminal system for Montreal's residential subscribers is scheduled for December 1988. The Alex terminal will be manufactured by Northern Telecom Canada.

Neither Telematica nor Bell Canada has yet decided to offer terminals to subscribers free-of-charge, a policy that is thought to have contributed greatly to the immediate success of the Minitel system in France.

Musicnet

Begotel Foundation (Netherlands), developers of the Begotel videotex service designed for music industry professionals (retailers, manufacturers, distributors), in which Paul Budde Communication has also been involved, will launch a similar system in the UK by July. Begotel has associated with Thorn EMI Business Communications, Vital Contact Services and Micro Scope for the launch of a British version of Begotel named Musicnet.

Musicnet provides a catalogue of tapes, records and compact discs allowing retailers to order on-line. Thorn EMI has won exclusive rights to provide its terminals and PCs to retailers; Micro Scope will provide communications and networking consultancy.

Korean terminal

Washington's Madison National Bank will test a Korean-made hand-held terminal for its new "Pocket Teller" service — the latest variation on the bank's "Home Teller" and "Office Teller" telebanking ventures. The unit, expected to cost under US$100, was developed in conjunction with Spectrum Concepts of New York and built by Daewoo Telecom. The 87 mm x 175 mm x 25 mm terminal has a two-line, 16-character liquid crystal display, a 300-baud modem and can be controlled by seven keys plus the 10-digit keypad. The terminal connects to a standard phone, allowing customers to conduct telebanking functions (funds transfer, account status, bill paying, etc.) via the keypad.

Phoneline on trial

The Royal Bank of Scotland has started trials for its voice service Phoneline. Customers of four of the banks' 850 branches are invited to participate in the trial. Developed by British Telecom, the voice service provides information on balances of accounts, details of last six transactions, cheque book requests and statements. Telephone calls are transmitted directly to the banks' central computer which answers queries with a "natural sounding voice". Users need only be equipped with ordinary telephones and calls are charged as a regular local call.

Minitel for Swedes

At least fifteen manufacturers in Sweden are involved in distributing free videotex terminals to Swedish households in order to stimulate the usage of new electronic services. At this moment a pilot project is in operation in the city of Vasteras, using the new Swedish Electronic White Pages "Teleguide". 40,000 terminals are ordered for 1989 and from 1990 onwards 6,000 per day have to be installed. eti

MARGARET THATCHER

KNOWLEDGE MAKES A NATION

Royal Society address by Mrs Thatcher

British PM — Margaret Thatcher, at a recent Royal Society dinner in London, reset government priorities in the sciences. Her comments have particular relevance to Australia.

A nation which does not value trained intelligence is doomed. Science and the pursuit of knowledge are given high priority by successful countries, not because they are a luxury which the prosperous can afford, but because experience has taught us that knowledge and its effective use are vital to national prosperity and international standing.

It is mainly by unlocking nature's most basic secrets, whether it be about the structure of matter and the fundamental forces or about the nature of life itself, that we have been able to build the modern world. This is a world which is able to sustain far more people, with a decent standard of life, than Malthus and even thinkers of a few decades ago would have believed.

It is not only material welfare. It is about access to the arts, no longer the preserve of the very few, which the gramophone, radio, colour photography, satellites and television have already brought, and which holography will transform further.

But we need to guard against two dangerous fallacies: first that research should be driven wholly by utilitarian considerations; and second, the opposite, that excellence in science cannot be attained if work is undertaken for economic or other useful purposes.

We should not forget that industry has had its share of Nobel prizes. AT and T for the transistor; IBM for warm super-conductors; EMI for x-ray tomography. It is time we won some more.

Support

Of course, the nation as a whole must support the discovery of basic scientific knowledge through government finance. But there are difficult choices and I should like to make just three points.

First, although basic science can have colossal economic rewards, they are totally unpredictable, and therefore the rewards cannot be judged by immediate results. The value of Faraday's work today must be higher than the capitalisation of all the shares on the Stock Exchange.

Second, no nation has unlimited funds, and it will have even less if it wastes them. A commitment to basic science cannot mean a blank cheque for everyone with — if I may put it colloquially — a bee in his bonnet. That would spread the honey too thinly.

So what projects to support? Politicians can't decide and heaven knows it is difficult enough for our own advisory body of scientists to say yea or nay to the many applications. I have always had a great deal of sympathy for Max Perutz's view that we should be ready to support those teams, however small, which can demonstrate the intellectual flair and leadership which is driven by intense curiosity and dedication.

'We have to rely on observations of natural systems'

A good researcher is keenly competitive and wants to be first. The final stage of the race for the DNA structure was as exciting as any Olympic marathon. The natural desire of gifted people to excel and gain the credit for their work must be harnessed. It is a great source of intellectual energy.

Immeasurable

We accept that we cannot measure the value of the work by economic output but this is no argument for lack of careful management in the way specific projects are conducted. The money is not for top-heavy administration but for research.

If only we could cut some £20 million from very large scale projects — where the non-scientists sometimes outnumber the scientists — that money could provide support for hundreds of young researchers whose requirements are measured in thousands of pounds.

My third point is that, despite an increase in the basic science budget of 15 per cent in real terms since 1979, the United Kingdom is only able to carry out a small proportion of the world's fundamental research, and that, of course, is true of most countries.

It is therefore very important to encourage our own people to be aware of the work that is going on overseas and to come back here with their broadened outlook and new knowledge. It is also healthy to have overseas people working here.

This country will be judged by its contribution to knowledge and its capacity to turn that knowledge to advantage. It is only when industry and academia recognise and mobilise each other's strengths that the full intellectual energy of Britain will be released.

The Royal Society's Fellows and other scientists, through hypothesis, experiment and deduction have solved many of the world's problems. Today, there are others.

For generations, we have assumed that the efforts of mankind would leave the fundamental equilibrium of the world's systems and atmosphere stable. But it is possible that with all these enormous changes (population, agricultural, use of fossil fuels) concentrated into such a short period of time, we have unwittingly begun a massive experiment with the system of this planet itself.

Recently three changes in atmospheric chemistry have become familiar subjects of concern.

Fear

The first is the increase in the greenhouse gases — carbon dioxide, methane, and chlorofluorocarbons — which has led some to fear that we are creating a global heat trap which could lead to climatic instability. We are told that a warming effect of 1 degree centigrade per decade would greatly exceed the capacity of our natural habitat to cope. Such warming could cause accelerated melting of glacial ice and a consequent increase in the sea level of several feet over the next century.

This was brought home to me at the Commonwealth Conference in Vancouver last year when the President of the Maldive Islands reminded us that the highest part of the Maldives is only six feet above sea level. The population is 177,000.

It is noteworthy that the five warmest years in a century of records have all been in the 1980s — though we may not have seen much evidence in Britain.

The second matter under discussion is the discovery by the British Antarctic Survey of a large hole in the ozone layer which protects life from ultra-violet radiation. We don't know the full implications of the ozone hole nor how it may interact with the greenhouse effect.

Common sense

Nevertheless it was common sense to support a worldwide agreement in Montreal last year to halve world consumption of chlorofluorocarbons by the end of the century.

As the sole measure to limit ozone depletion, this may be insufficient but it is a start in reducing the pace of change while we continue the detailed study of the problem

on which our (the British) Stratospheric Ozone Review Group is about to report.

The third matter is acid deposition which has affected soils, lakes and trees downwind from industrial centres. Extensive action is being taken to cut down emission of sulphur and nitrogen oxides from power stations at great but necessary expense.

In studying the system of the earth and its atmosphere we have no laboratory in which to carry out controlled experiments. We have to rely on observations of natural systems. We need to identify particular areas of research which will help to establish cause and effect. We need to consider in more detail the likely effects of change within precise timescales. And to consider the wider implications for policy — for energy production, for fuel efficiency, for reforestation.

This is no small task, for the annual increase in atmospheric carbon dioxide alone is one of the order of three billion tonnes. And half the carbon emitted since the industrial revolution remains in the atmosphere.

We have an extensive research program at our meteorological office and we provide one of the world's four centres for the study of climatic change.

We must ensure that what we do is founded on good science to establish cause and effect.

In the past when we have identified forms of pollution, we have shown our capacity to act effectively. The great London smogs are now only a nightmare of the past. We have cut airborne lead by 50 per cent. We are spending £4 billion on cleansing the Mersey Basin alone. And the Thames now has the cleanest metropolitan estuary in the world.

Well spent

Even though this kind of action may cost a lot, I believe it to be money well and necessarily spent because the health of the economy and the health of our environment are totally dependent upon each other.

The Government espouses the concept of sustainable economic development. Stable prosperity can be achieved throughout the world provided the environment is nurtured and safeguarded.

> *'. . . no nation has unlimited funds'*

Protecting this balance of nature is therefore one of the great challenges of the late twentieth century and one in which I am sure your advice will be repeatedly sought.

I have spoken about my own commitment to science and to the evironment. And I have given you some idea of what government is doing. I hope that the Royal Society will generate increased popular interest in science by explaining the importance and excitement of your work.

When Arthur Eddington presented his results to this society in 1919, showing the bending of starlight, it made headlines. It is reported that many people could not get into the meeting so anxious were the crowds to find out whether the intellectual paradox of curved space had really been demonstrated.

Should we be doing more to explain why we are looking for Higgs Boson at CERN and trying to decode the human genome? This is a golden age of discovery and new thought. The natural world is full of fascination providing the doors of understanding are opened. eti

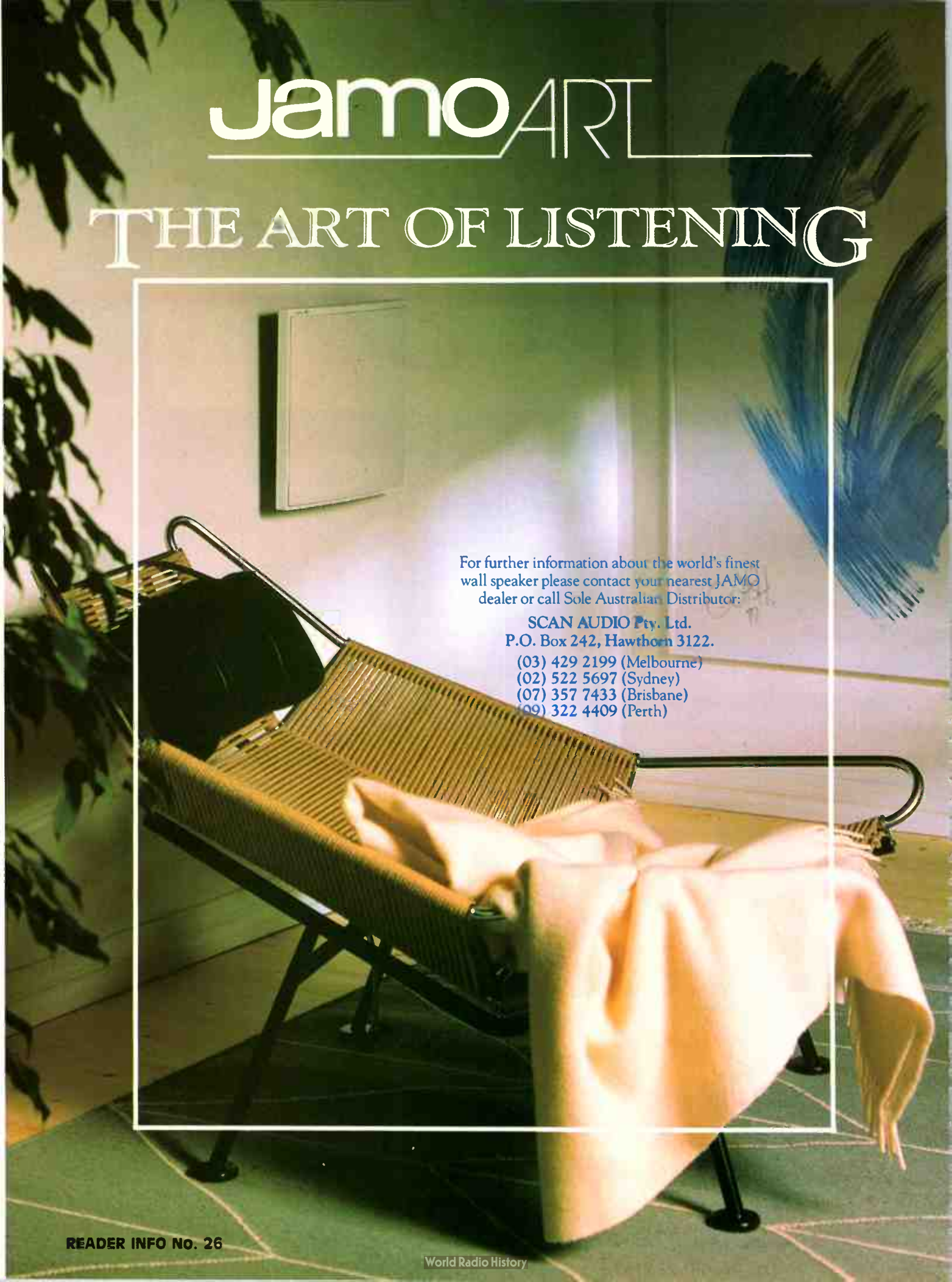
eti

Sound insights

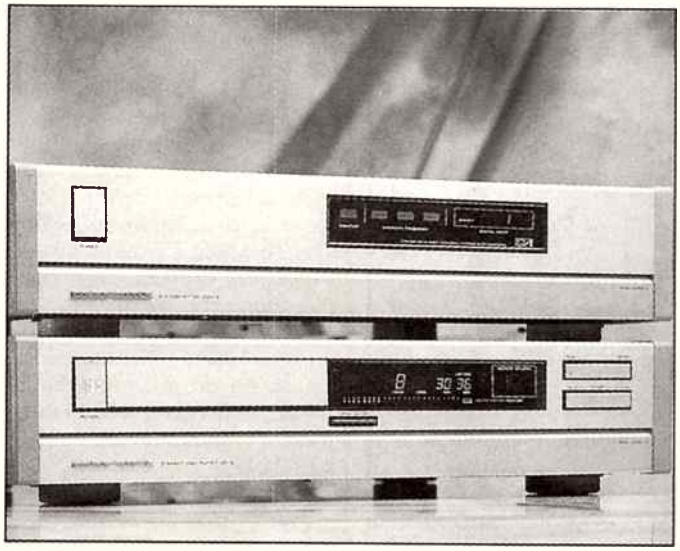
A NEW CD PLAYER FROM TECHNICS

YAMAHA AVX-100

MARANTZ WUNDERKIND SPILLS THE BEANS



READER INFO No. 26



Three-piece CD player ▲

Marantz has released a CD player which consists of separate CD drive, DAC converter and remote control unit. The drive and the DAC converter of the CD 12 player are connected by polished mica optical fibre cable, to keep the two electrically isolated for signal purity. Much of the engineering and design concentrates on eliminating *jitter* — unwanted constantly shifting time errors. The separate DAC allows a DAT player to be connected; the CD 12 will automatically switch to the correct sampling frequency — 32, 44.1 or 48 kHz.

READER INFO No. 287

Large screen television ▼

Akai is assembling its new CT-3870 digital stereo TV in Germany. This 70 cm model features built-in Tele-Text, with menu driven text mode for news, weather or stock market information. Microprocessors that compensate for the aging of components are called *an alignment computer* by Akai.

A 20 watts per channel stereo amplifier drives speakers on the lower front of the set.

READER INFO No. 286

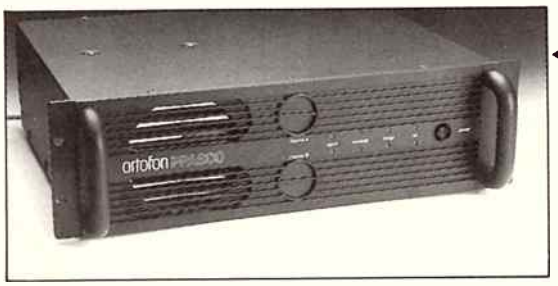
Designed for the driver ▼

Philips has released its latest car radio tuner/cassette player, the DC681. The new unit has a few interesting features including a factory encoded four-digit security code, an automatic switching to radio during any fast winding of cassettes, and a feature called autoshore, which, at the push of a button, automatically selects and stores the five strongest AM and FM stations in any locality.

A standby mode gives radio reception while a cassette is inserted.

A smart design is the use of a multi-function control located on the bottom right hand side of the fascia where it's most easily reached by the driver. This control operates all major functions — volume, bass, treble, balance and fader — by pushing the required function button and adjusting. The *command* control will then automatically revert to volume two seconds after last used.

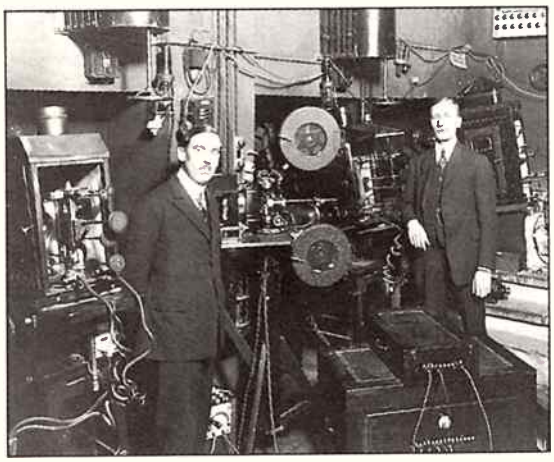
READER INFO No. 289



Power amplifier

Danish turntable cartridge maker, Ortofon, has developed its first ever amplifier in its seventieth year, the PPA 600 power amplifier. The PPA was developed for high-end hi-fi users but then modified for professional use. Minimum output per channel with both channels driven into 8 ohms is 225 watts RMS. The 16 MOSFET metal power transistors produce peak output currents in excess of 40 A, enabling low impedance or highly reactive speakers to be driven. From Scan Audio, PO Box 242, Hawthorn 3122. ☎ (03) 429 2199.

READER INFO No. 290



Axel Petersen and Arnold Pontsen founded Ortofon in 1918. Todoy their company is producing devices like the one ot top.

Software for loudspeaker design

CALSOD is a software package enabling computer-aided loudspeaker system optimisation and design. Developed in Australia and aimed at loudspeaker manufacturers it runs on an XT or compatible with a graphics card and at least 512K bytes of RAM.

Useful for crossover design, driver choice and cabinet construction it costs $349 from Audiosoft, 128 Oriel Road, West Heidelberg 3081.

READER INFO No. 291

Cartridge release

Stanton has released a stereo magnetic cartridge, the WO Stanton Collector Series 100. The stylus is a Stereohedron diamond, the cantilever is sapphire coated for rigidity, the body is titanium coated for rigidity in mounting.

The cartridge is packaged in a walnut cabinet which includes a brush, a miniature screwdriver and a metal container for spare styli. Distributed by Crestmore, 201 Bobbin Head Road, North Turramurra 2074. ☎ (02) 44 2155.

READER INFO No. 292

ROCK SOLID SOUND, LITERALLY!

Hi-fi among the petunias

If you are heavily into garden variety sound systems, Les Cardilini tells why this might be just the thing for you.

An American company has put together a range of hi-fi loudspeakers in the shape of large, garden rocks, which can be landscaped into rockeries and grotto settings. They are now available here in Australia.

The innovative loudspeakers are weatherproof, handle lots of power and are designed to fade into their environment. Visually they tend to blend, rather than conflict, with their natural surroundings in a rockery or landscaped courtyard or barbecue area.

And, where conventional speaker enclosures would need to be protected from the sun and rain the Rockustics are quite waterproof and weatherproof, according to Rebel Audio, the local distributors.

It has even been suggested that Rockustics were tested at the factory by submerging them completely in water. This is not to imply, however, that they can be used to play sound under water in swimming pools, where a different kind of speaker altogether is needed.

In an outdoor setting the Rockustics should also be relatively secure as they are not readily recognised as loudspeakers, and even if they were, they are heavy and bulky enough to pose a few handling and transport difficulties for a would-be thief. Accordingly, they might be permanently installed and wired in place to provide music in indoor or outdoor settings and around barbecues, or reception areas at the office - imagine being paged by a philodendron!

Wide range

The smallest speaker in the Rockustics range is the Rocky Junior, a two-way model rated at 100 watts, continuous. It is nonetheless relatively large and heavy. The Hillside, recommended for sloping ground, and the Stonehenge upright model are both three-way systems, each with a rated power handling of 150 watts, continuous. All three use ferro-fluid cooling in the tweeter.

A fourth model, called the Sub-Rock, is a sub-woofer that can be used in conjunction with the Rocky Junior, Stonehenge or Hillside units. The Sub-Rock houses a 380 mm driver and is rated at 250 watts, continuous, with a bass response down to 33 Hertz.

The Rockustics are available in grey or brown, and custom colours may be obtained on quantity orders. Recommended retail prices for the Rockustics range from $600 to $1750. Further information: Rebel Audio Pty., Ltd., 286 Great North Road, Five Dock, NSW, 2046, ☎ (02) 713 1727.

Some extra functions on the Technics SL-P770 lift it out of the ordinary. Louis Challis found it fun, but nevertheless illegal.

When I received the Technics SL-P770 CD player I thought to myself: 'Oh no, not another CD player'. Within a few hours, however, any such feelings were completely dispelled, for here is one of the most 'avante garde' CD players on the market today, with features and performance that few other manufacturers are currently able to match.

During my visit to the Japan Audiofair in Tokyo last November, I saw the SL-P1200, the flagship of the Panasonic range of professional compact disc players. The catch was that as good as the SL-P1200 is, its layout, appearance and to some extent even its functional controls are only really at home in a professional recording studio.

By contrast, the SL-P770 offers most of the best features of the SL-P1200, but supplement these with others which are more practical and, for a serious audiophile, far more beneficial. At first sight the front panel of the SL-P770 is a little daunting. It has more controls than any other CD player I have yet reviewed. But for all that, within a short period of time I gained the impression that not only are those controls more desirable, but they meet a pressing need few other CD players are currently capable of matching.

The most exciting feature on this CD player is its large visual display section which dominates appearance and functional operation of the player. Its functional controls are grouped into four major sections, two of which are below the major display, the third group being immediately to the right and the fourth group placed at the botton right-hand corner.

The first and most oft-used controls are OPEN/CLOSE, STOP/PAUSE and PLAY. The last two have different coloured LED's to indicate that they have been activated. The forward and reverse index and forward and reverse track skipping buttons are only small controls as they are far less frequently used. Immediately above these primary controls is a group of 20 numbered push buttons for providing direct entry to up to 20 tracks, or for programming a sequence of tracks with the programme control. Adjacent to these are four push buttons, one numbered '+10', one numbered '0', and a program button through which various tracks may be sequentially selected in a desired order from those on the disc. Two other buttons allow you to clear those tracks or to recall the sequences that have been selected to check that they conform to what you entered.

Unusual

On the right-hand side of the display is a series of unusual buttons. The first of these is labelled "Search Fast/Slow/Off" which activates the large rotary search dial. This concept was first introduced on professional CD players to allow the user to manually track forwards and backwards on a disc with audible output being provided in much the same way that you would queue a conventional disc on your record player, backwards and forwards with your fingers (if you are game) to find the point of the track from which you wish to proceed to play a selected exerpt.

Admittedly, there aren't all that many people who want to program backwards and forwards through a disc with manual control. However, for those of you who do, this player provides that function, together with quite a few other functions that are attractive for professionals and amateurs alike.

The next control in the sequence is the "edit" control, which allows the user to calculate the number of tracks that can be recorded on two (2) sides of a cassette tape. This allows you to take into account the length of the tape used so that there are either no interruptions, or, at worst, minimum interruptions of the sound, on the tracks. The whole concept and feature is highly illegal in this country (or any other for that matter), so it is with some trepidation I describe the features involved.

Delightful feature

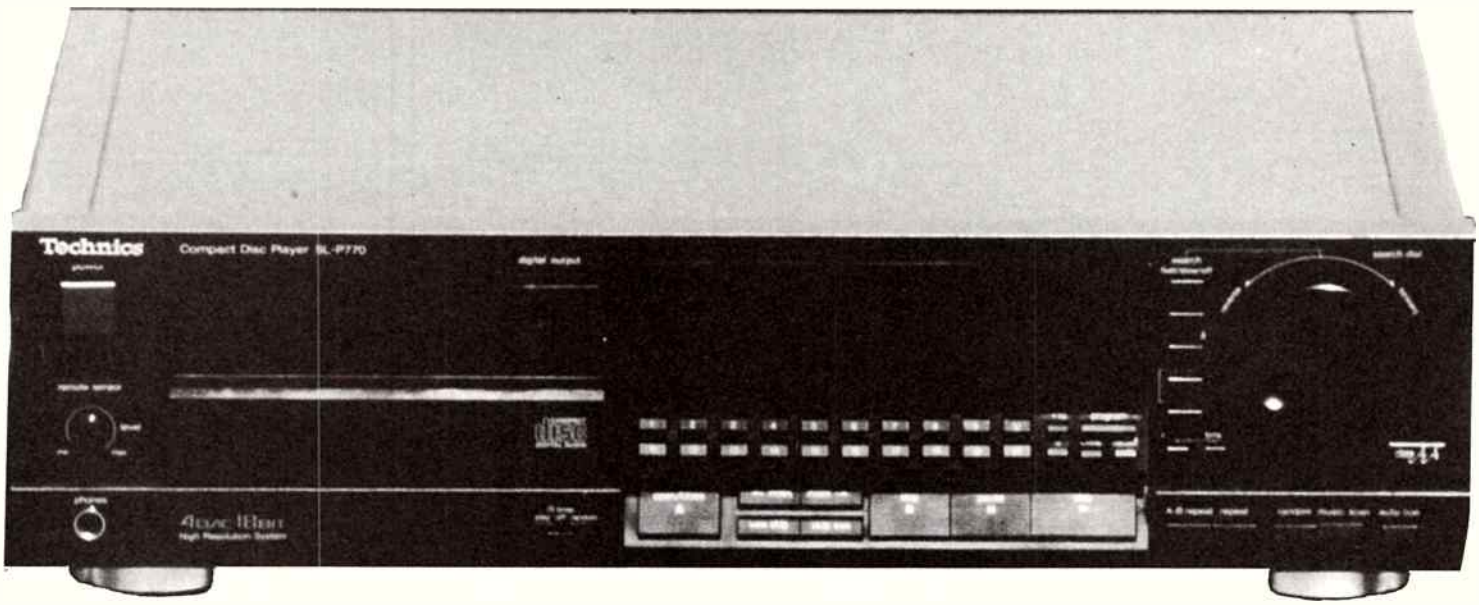
When used in conjunction with the tape side select buttons (side A or B) and also with the program button, an almost automatic computation and assessment of which tracks and which order are most appropriate to fit details on the side of a given tape can be carried out. It was only after I had played with the cassette recorder that I discovered how delightful this feature really is. The best part was still to come.

The next control on the left-hand side of the display is the "peak button". This has been provided to make the task of finding the recorded 'peak program level' on a disc that much easier. This is useful when recording with a CD player onto a cassette player. However 'naughty' or 'illegal' it might be, this function is also mighty convenient, especially when combined with the selection control for the fluorescent display provided by the bottom control in the grouping. This control, labelled DISPLAY, allows you to change from the normal time-related display (with the available recording time on the disc shown in minutes, up to a maximum of 76) into a dual channel fluorescent peak reading level meter, with bright peak reading plasma bars covering the range – 50 to 0 dB, in exactly the same way you would find them on a quality cas-

> *'. . . it is with some trepidation I describe the features involved'*

FEATURES MAKE PERFECT

If it's fun, it's illegal



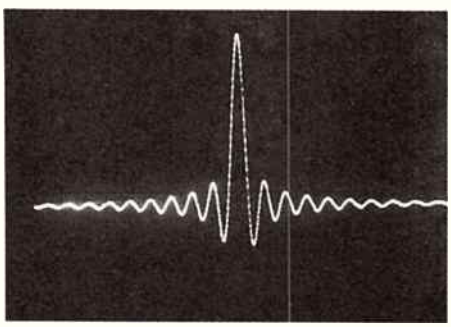
sette recorder. However, as it happens, this is probably the first time that somebody has seen fit to provide this function on a CD player and, with it, the automated combined functions that allow you to determine where that peak is. The player even cycles through the highest recorded levels for you so that you can conveniently set the recording level of your cassette player only once and you won't over-modulate the recorded signal.

The other controls provided in the same grouping are the normal 'A-B' peak level search buttons, the display mode select buttons, a repeat button and the time display select button.

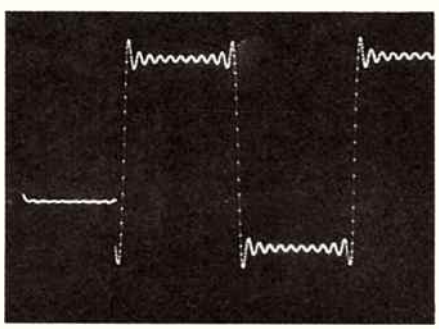
Random play

At the bottom right-hand corner of the player are five buttons which provide: the normal A-B repeat button for playing sections of a disc; the conventional REPEAT button which allows a disc to be played from end to end in the cyclical manner; the RANDOM PLAY button that allows the unit's micro-processor to select the sequence of tracks in a random order (which are never quite the same); and the music SCAN button which allows the player to play the first 15 seconds of each track, so that you can identify what is on the tracks and whether you like the music or not!

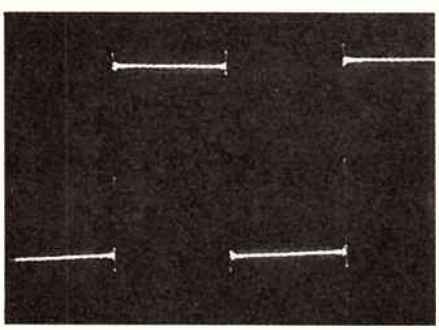
The last control in the grouping is the automatic play stand-by button, which allows you to queue into and out of the 'play mode' into the 'pause mode' by just pressing the PLAY button alone. The player provides two direct digital outputs on the back panel, firstly as a straight electrical co-axial socket and, secondly, as an optical output matching



Impulse response from a test disc.



Response to 1000 Hz square wave.



Response to 100 Hz square wave.

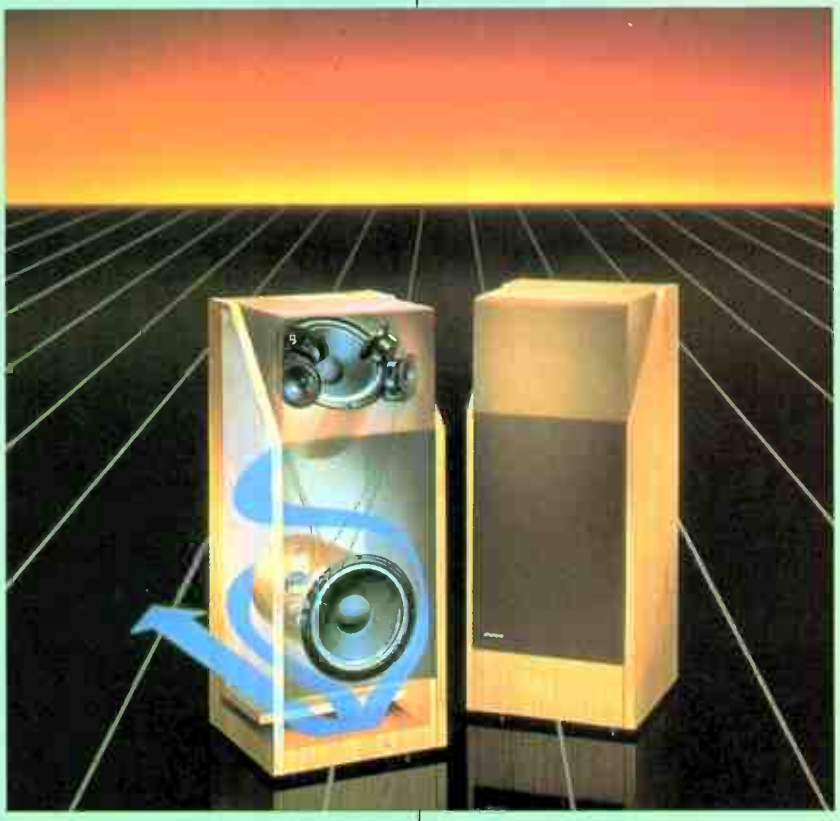
BOSE®

The Bose® 601™ Series III Direct/Reflecting® Loudspeaker System

Bose engineers have invested more than 25 years of ongoing research seeking one goal—re-creating the realism of a live performance.

The next best thing to hearing music live is hearing it through a Bose® Direct/Reflecting® speaker.

Drawing on the heritage of the internationally acclaimed Bose 901® speaker, the 601™ speaker gives you the best seat in the house—wherever you sit or stand.



The research that changed sound

Through our extensive acoustical research into live sound, we learned that focusing on only one musical parameter such as frequency response and expecting realistic sound is like trying to create a lifelike painting by concentrating solely on colour. As with visual images, live sound has perspective, clarity and proportion.

We designed our speakers based on the natural combination of direct and reflected sound. The difference between listening to conventional speakers and Bose Direct/Reflecting® speakers is like the difference between viewing a movie on a television versus experiencing it in a theatre.

The 601 system brings a three dimensional sensation to music—giving the sound depth, height and width. In short, it seems to come alive!

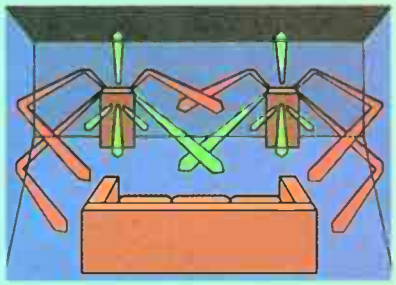
In a live performance, the majority of sound reaches your ears after being reflected off the walls, floors and ceiling. With conventional speakers, you mainly hear only direct sound. Bose Direct/Reflecting® speakers add the missing elements of music by bringing you the natural combination of direct and reflected sound (see diagrams at right). The result is a lifelike soundstage that's practically like being there.

The performance you need for audio, video and digital

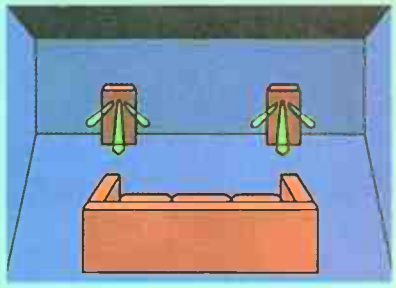
With most conventional speakers, you hear stereo in one or two parts of the room. Everywhere else, you hear primarily one speaker. The 601 system allows you to hear true stereo *everywhere* in the room—even when you are directly in front of one of the speakers.

The 601 system is the ideal cornerstone for a complete home entertainment system. It unleashes the full potential of your sound system, efficiently produces excellent sound and easily handles high power. This rare performance combination allows you to enjoy today's power-demanding sound sources such as digital audio at true-to-life volume levels.

The Bose 601 system also makes it possible to use your stereo system in a new way: as part of a total audio/video system. It is designed to produce greater realism with all video sound sources—especially stereo televisions, hi-fi VCRs and video disc players.



Bose 601 Direct/Reflecting® system.



Conventional speaker system.

Bose Australia Inc., 11 Muriel Avenue, Rydalmere, NSW 2116 Telephone: (02) 684 1022, 684 1255

Bose Distributors:
NSW and VIC: Bose Australia (Reverse charge (02) 684 1022); QLD: Stereo Supplies (07) 229 7930; WA: Prosound (09) 325 1066; SA: Blackwood Sound (08) 278 1281; TAS: Chessman Distributors (003) 26 4622.

Bose 7

READER INFO No. 28

Technics CD player

MEASURED PERFORMANCE OF TECHNICS COMPACT DISC PLAYER
MODEL No. SL-P770
SERIAL No. AD7L24C007

1. FREQUENCY RESPONSE 20 Hz to 20 kHz ±1.2dB
5 Hz to 22.05 kHz ±0.8dB

2. LINEARITY @ 1kHz

NOMINAL LEVEL	LEFT OUTPUT	RIGHT OUTPUT
0 db	0.0	0.0
−1.0	−1.0	−1.0
−3.0	−3.0	−3.0
−6.0	−6.0	−6.0
−10.0	−10.0	−10.0
−20.0	−20.0	−20.0
−30.0	−30.1	−30.2
−40.0	−40.0	−40.1
−50.0	−50.0	−50.1
−60.0	−60.0	−60.0
−70.0	−70.1	−70.1
−80.0	−80.6	−80.1
−90.0	−90.0	−89.7

3. CHANNEL SEPARATION

FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
100 Hz	−128.5	−137
1 kHz	−118.2	−125.1
10 kHz	−99.3	−102.1
20 kHz	−93.1	−95.0

4. DISTORTION (@ 1 kHz)

Level	2nd	3rd	4th	5th	THD%
0	−104.0	−88.0	—	—	0.004
−1.0	−103.3	−90.1	—	—	0.0034
−3.0	−102.1	−98.3	—	−102.9	0.0014
−6.0	—	−83.9	—	−84.4	0.0088
−10	—	−78.5	−107.7	−81.5	0.014
−20	−63.2	—	−72.4	−70.2	0.073
−30	−63.6	−85.8	—	—	0.07
−40	−63.1	−80.5	—	—	0.074
−50	−64.3	–	—	—	−.072
−60	−58.9	–	—	—	0.11
−70	−48.1	−39.6	—	—	1.12
−80	−31.2	−32.5	−35.6	−30.6	5.0
−90	−16.6	−28.8	−24.6	−14.9	24.3
(@ 100 Hz)					
0	−109.0	−87.5	−115.9	−103.3	0.0043
−20	−64.2	—	−80.3	−104.0	0.046
−40	−66.3	−83.5	−81.7	—	0.049
−60	−62.0	−72.9	−68.7	66.1	0.10
(@6.3 kHz)					
0	−101.2	−87.7	—	—	0.0042

5. EMPHASIS

Frequency	Recorded Level	Output Level (L)	Output Level (R)
1 kHz	−0.37 dB	−0.2	−0.2
5 kHz	−4.53 dB	−4.1	−4.3
16 kHZ	−9.04 dB	−8.7	−8.8

6. SIGNAL TO NOISE RATIO

Without Emphasis	104 (Lin)	112 dB(A)
With Emphasis	106 (Lin)	115 dB(A)

7. FREQUENCY ACCURACY
(19.999 kHz) ±1.0 Hz for 20 kHz test signal

8. SQUARE WAVE RESPONSE
(See attached photos)

9. IMPULSE TEST
(See attached photo)

DIRTY RECORD TEST
Using Philips NR4A (410-056-2)
Interruption in Information Layer
400 micrometer; Passed
500 micrometer; Passed
600 micrometer; Passed
700 micrometer; Passed
800 micrometer; Passed
900 micrometer; Passed

Black Dot at Readout Side
300 micrometer; Passed
500 micrometer; Passed
600 micrometer; Passed
800 micrometer; Passed

BLACK STRIPE TEST (passed)

SKEW TRACKING TEST
Test Disc Skew angle 30° skew; Passed.

OUTPUT IMPEDANCE
Headphone Amplifier output Impedance 31 ohms

the new Japanese Standard for high-speed wide band-width optical cable connections.

The design also incorporates a number of other relatively new features, including an 18 bit, four times over sampling circuit, four separate digital to analogue, converters and a number of other features, some of which may be of questionable value. The first of those is a multi-layer base, three layer top and floating optical deck structure, which the blurb assures us provides resistance against "sound muddying, vibrations and resonance". Although the player also contains a front panel mounted headphone socket with separate volume control, the remote control does not incorporate a volume control function, which I have found to be beneficial when listening to music in my living room.

The first thing I did with the SL-P770 CD player before I actually tested it in the labaratory was to try it out using some nasty discs, which other CD players, including the unit I am currently using at home, will just not play.

The worst of these is an early release of 'Dire Straights-Communique', clearly labelled "sample not playable", and which in the past no other CD player

Raw Road Power

Pioneer Multi-Play is six times better...

A built in computer memory lets you programme up to 32 tracks from the 6 disc magazine.

Enjoy around six hours of your favourite music without interruption.

The remarkable in-dash CD controller includes cassette deck and supertuner.

All this plus an infra-red remote control.

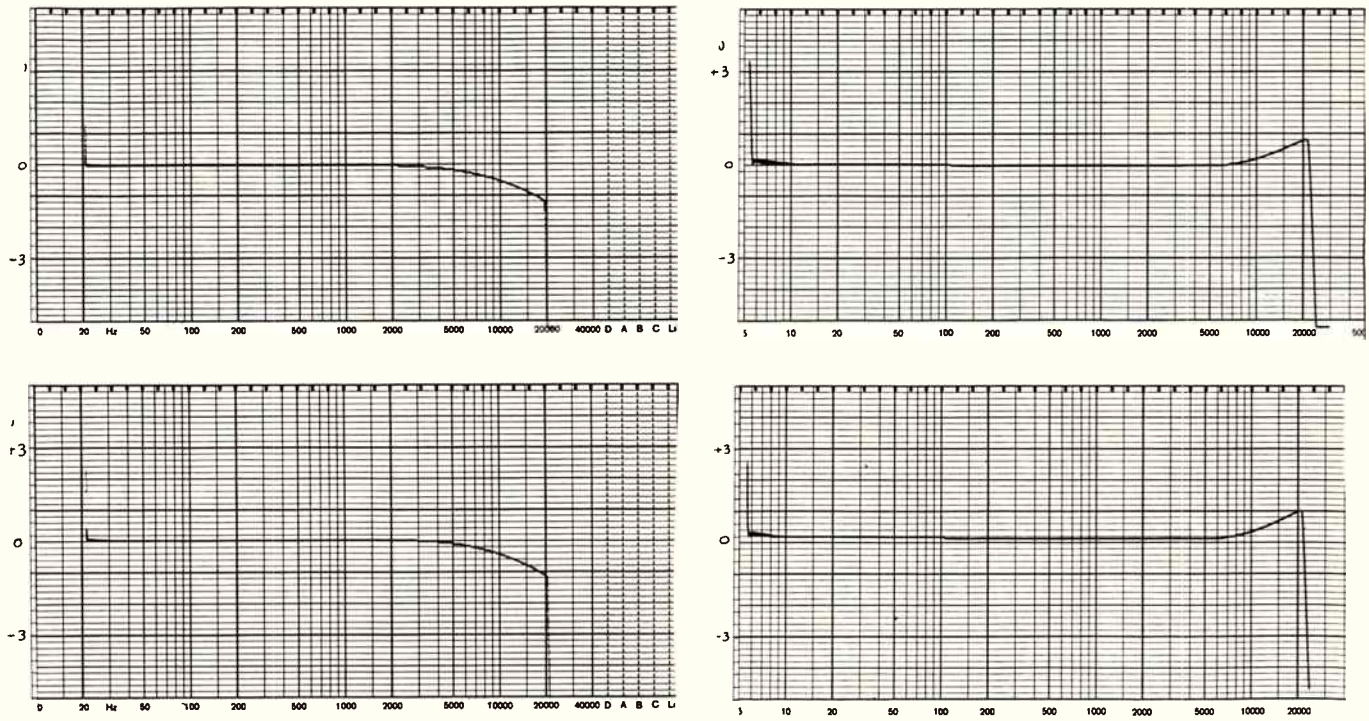
Music...how music should sound

PIONEER

READER INFO No. 30

For Further Information Telephone Pioneer Toll Free 008 33 8439

Technics CD player



Frequency response of the SL-P770. Left channel is at top. Right is at bottom.

has ever successfully played.

The SL-P770 played it without a hiccup, as if the words on the front were, in fact, just meant to frighten away the "also rans". The second test disc I tried was one with a gross eccentricity and a knocked out centre hole, that no other previous CD player had ever played. This, too, was taken in its stride.

Impressed

To say I was impressed is probably an understatement.

The objective testing of the SL-P770 revealed some fairly conventional results in that the frequency response was ±1.2 dB down at 20 kHz with one test disc and +0.8 dB up with another set of test discs.

Yes, there *must* be something wrong with the test discs! Overall, however, it is clear from the differential sets of results that the overall frequency linearity of the CD player is close to being ruler flat all the way from 5 Hz to 22 kHz.

The linearity is reasonably good all the way down to −70 dB, still very good at −80 dB and better than most other CD players I have yet seen at −90 dB. Channel separation is exemplary being a magnificent −128 dB between right and left and 137 dB between left and right at 100 Hz. This figure is still better than 93 dB from right into left channel at 20 kHz. These figures are rather impressive and I think equal to the best I have seen to date. The distortion figures are good, but not superlative, all the way down to −80 dB, and like it or not the 18 bit revolution of the DAC certainly means better signal to noise, but certainly does not result in lower distortion.

The signal to noise figures measured without emphasis are exemplary at 104 dB unweighted and 112 dB(A), whilst with emphasis they are 106 dB unweighted and 115 dB(A) which are hard to beat.

The frequency accuracy is precisely −1 Hz at 20 kHz, which is quite acceptable, and the displayed square wave performances are what you would expect to see, with a high quality four times over sampling digital filter providing symetrical ringing on both sides of the impulse response, and absolute symmetry on the 1 kHz square wave at both 1 kHz and 100 Hz.

Subjective

Two of the discs that I utilised for my initial auditioning of the SL-P770 with a set of new speakers that I wished to put through their paces were new releases from CBS with Leonard Bernstein conducting the New York Philharmonic Orchestra playing Karl Neilson's Symphonies No. 3 and No. 5 (CBS MK-44708) which, although somewhat unusual, is nonetheless a dramatic and exciting pair of symphonies, well suited for this specific purpose.

I was very impressed with the clean and uncoloured clarity of sound which the SL-P770 CD player provided. I also played the matching disc that CBS provided which is John Tingle's "Classical Reflections" (CBS 462792 2); is a potpourri of selections of classical music for the 'Australian market'. Whilst I am generally not always happy to play potpourri selections for this purpose, for once this disc did provide some very suitable music with which to evaluate the CD player, albeit in moments of less serious listening.

The third disc was one that I had always suspected contained emphasis — Paul McCartney's "Give My Regards to Broad Street" (Parlaphone CDP7 46043 2). After I had loaded the disc, up came the "emphasis" light to confirm my suspicions that this disc had been 'pre-emphasised' to compensate for the original quality of the analogue recording.

The SL-P770 is one of the most potent and cost effective CD players that a semi-professional musician would wish to buy. My only criticism is that it doesn't have a remote volume control. When it does, it will be extremely hard to get any CD player to better its functionality and performance!

MODEL NO. SL-P770		
SERIAL NO. AD7L24C007		
DIMENSIONS	Width	413mm
	Height	116mm
	Depth	333mm
	Weight	6.5kg
	R.R.P.	$1199

Before you it's best to get

Never before in the history of high fidelity sound has a range of hi-fi equipment received such rave reviews from the world's experts.

NAD, standing for New Acoustic Dimension, is a European company which set the entire hi-fi world on its ear by providing the previously unheard of. Superlative quality sound at a ridiculously low price.

We're not just talking about superior sound performance to competitors in NAD's price bracket, we're talking about superior performance to competitors at any price.

As you can imagine, this really put the woofers amongst the tweeters.

Just how much it did, you can judge from the following:

"Nothing gives us more enjoyment than that rare event of finding a product to rave over and the cheaper the product the bigger the thrill. So when something (like this NAD) comes along that is both ridiculously cheap and ridiculously good, we tend to get rather ridiculous."

HI FI ANSWERS–(U.K.)

"What makes this receiver congenial to knob-shy listeners is that fact that it hides its sophistication behind a facade of rare simplicity. In welcome contrast to gaudy models speckled with flashing lights that make them seem like refugees from a penny arcade, NAD opts for visual reticence. In terms of audio styling, this is Saville Row. Front panels are dark, matte and muted. Controls are happily kept to an unconfusing minimum but amply serve all normal needs."

NEW YORK TIMES–(U.S.A.)

"All in all, this new NAD compact disc player is an obvious sonic winner. As a further bonus, its front panel controls are a pleasure to use, in contrast to (others, which are) baulky, frustrating and touch sensitive."

I.A.R. HOTLINE–(U.S.A.)

"Clearly the tuner is far above average: indeed there is no other we know of that can match its overall measured performance."

STEREO REVIEW–(U.S.A.)

"The NAD 6220 is a new cassette deck on the market and is yet another example of (NAD) putting all of their effort and most of their budget into producing a machine with excellent sound quality performance rather than offering lots of

buy a hi-fi a few quotes.

extra facilities. It is this very excellence of sound quality at a low price that gains this player the winner's prize in the budget category this year (1986)."

WHAT HI FI–(U.K.)

"If you believe that I'm impressed with NAD equipment you're right. In some 25 years of audio experience I have rarely encountered such fine sounding equipment at such realistic prices."

SUNDAY TELEGRAPH–(AUSTRALIA)

"...the NAD 5120 (turntable) stands out for me as the most interesting to listen to. Quite simply it allows you to hear more of the music than any of the other three, (Sansui, Harman/Kardon or B&O)."

POPULAR HI FI–(U.K.)

"In fact, the NAD units had such a good measured performance that no product (of the five) in this group could manage significantly better, which is astonishing (since all were double or triple the price and very highly regarded). It is directly due to the ability of their London based designer Bjorn-Erik Edvardson. As a comparative guide, I have never tested a Japanese amplifier that could match the NAD in this sort of detail."

NEW HI FI SOUNDS–(U.K.)

"In the case of the NAD 3020, we're dealing with an inexpensive, modest integrated amplifier. Don't let that fool you. It is capable of real-world performance far in excess of what its specifications indicate and cannot be judged by the same standards as other equipment in its price or power class. Quite simply, it's one of the best buys in audio."

STEREO/HI FI EQUIPMENT–(U.S.A.)

Now you've read what the hi-fi critics had to say. (Although you couldn't say they found much to criticise.)

However, if you can hardly believe your eyes at what you've just read, you are cordially invited to visit the specialist NAD dealer near you or phone (02) 597 1111 for further information.

We're confident you won't have any trouble believing your ears.

NAD

"Ridiculously good. Ridiculously cheap."

READER INFO No. 31

PROFILE OF A DESIGNER

Marantz audio wizard seeks product blessing

Ken Ishiwata

In this article, Pat Hayes takes an in-depth look at the man behind the Marantz drawing board.

Ken Ishiwata is not your run-of-the-mill hi-fi tradesperson. This Japanese audio wizard has made his name in Europe where he has lived for 20 years. The equipment he has been responsible for has a distinctly European flavour about it; he is into high-current "musicality" rather than technology for technology's sake.

As product manager and chief designer for Marantz International, he is based in Eindhoven in The Netherlands and the new range of audiophile Marantz equipment now being released around the world bears his distinctive "no frills but real music" mark.

On a recent visit to Australia, Ken Ishiwata met dealers and hi-fi enthusiasts to explain his philosophy, and to get their blessing for his new products.

A small man in a dark suit with his own unique version of the English language, Ishiwata's self-effacing manner changes when he stands up and explains about the passion a designer needs.

He is not afraid to speak of his appreciation of other hi-fi products which he thinks are also "musical". In particular, he likes Apogee speakers and the Krell amplifier.

"They are quite notable products. Respectable products. But when you look at, behind or inside — there is a lot of passion behind it. Designer passions."

Then, speaking of his own new top-end pair, the PM 95 amplifier and the CD 12 compact disc player, he states: "There is a lot of passion about our one as well. And we will keep, continue, doing this kind of work to improve musicality just for the sake of music not for just the sake of economics."

Music comes first

Although he is not averse to using the latest scientific advances in his designs (he has been quick to adopt optical connections in amplifiers and CD players) Ken Ishiwata is adamant that the music must come first.

"We are not using new technology for the sake of new technology. Nowadays when you talk of new technology in digital conversion you talk of 18 bit or 20 bit or some of them have come up with 22 bit; four times oversampling or eight times — some of them say 16 times. So, you know, all those numbers are supposed to perform better, but in reality it is not that simple.

"Music you can't judge by numbers."

Ken Ishiwata says that his work on esoteric hi-fi gear that costs an arm and a leg is not all for the well-heeled audio buff. "Of course, if you work on this type of product you know a lot of things."

As an example, Ishiwata recalled that last year, when Marantz released its classy PM94 amplifier, some people commented on the way separate heat sinks had been used for both right and left channel output transistors.

A power transistor needs to be bolted to a hefty piece of metal so that the heat it generates pumping music into a loud speaker can be dissipated. As a result, the operating temperature can be kept in the appropriate range. The PM94 uses separate heat sinks for each channel's output transistors. Ishiwata explained: "When there is high current demand the current is going through the power transistors. As a result the power transistors vibrate. This vibration, of course, is also travelling through the heat sink.

"Then, if the left channel and the right channel heat sinks are in one unit a kick drum recorded through the left channel will vibrate the other channel. So, dynamic microphonic distortion will occur.

"Those are the kinds of things that we have learned as a result of our work on this amplifier.

Ishiwata says that this work is not entirely to benefit the top-of-the line products.

"You learn a lot of things. If those technologies are affordable you can implement down the line, through the total range of amplifiers. Now, when you open all of our range of amplifiers, you will see independent heat sinks.

"This is just one example of our approach to the program we have learnt from the PM94 amplifier."

Pat Hayes is a journalist specialising in hi-fi audio at The Age newspaper, Melbourne.

The Morontz PM94 is one of the designs thot benefited from the Ishiwoto touch.

The interior of the PM94 shows the distinctive heotsinking.

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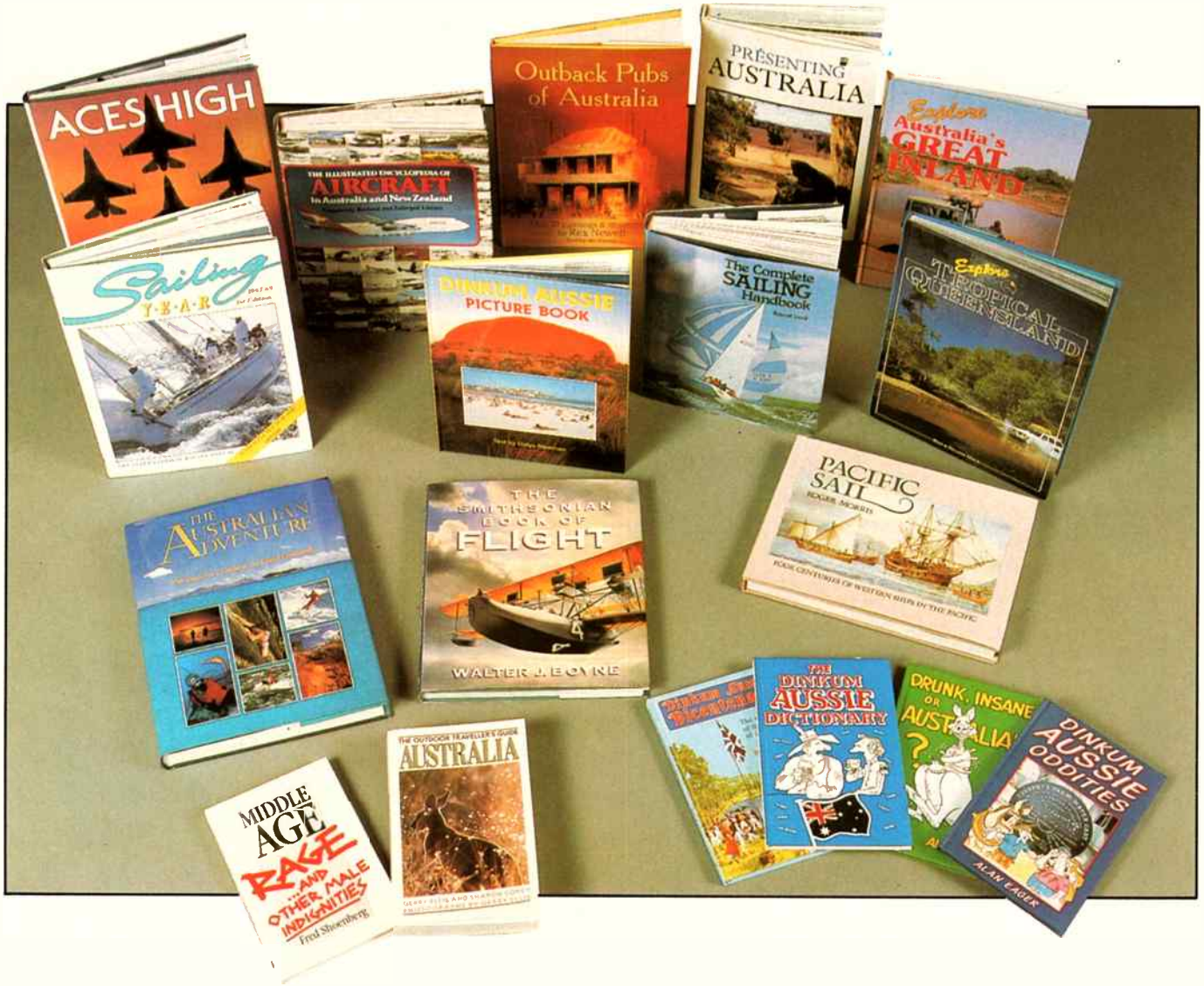

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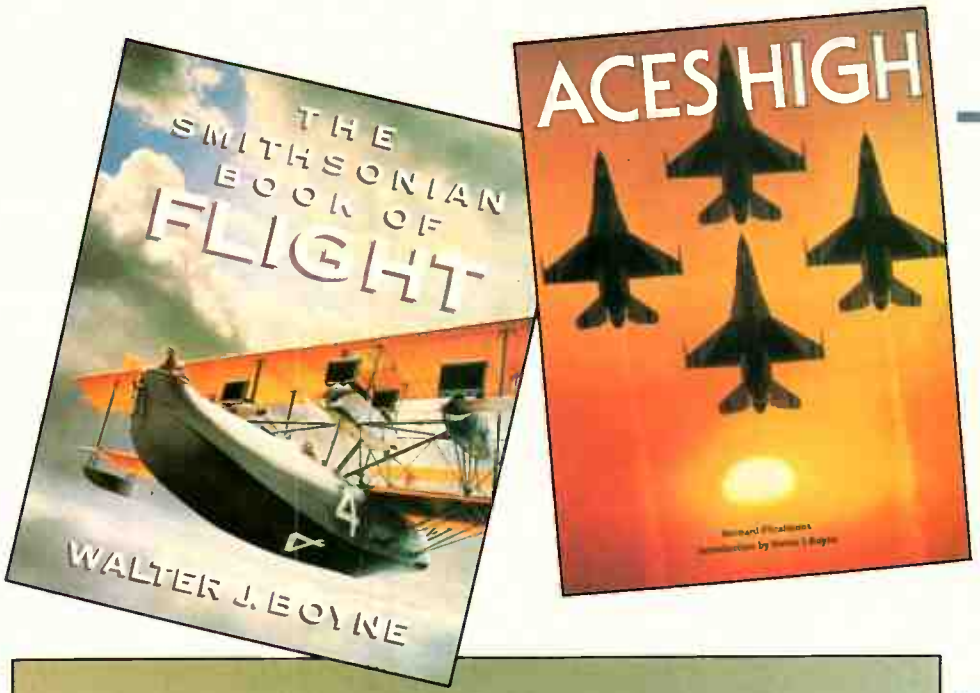

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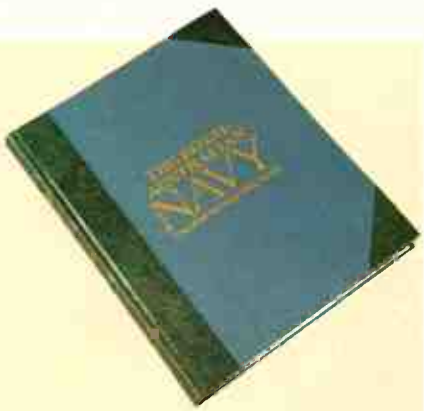

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READER INFO No. 32

MARY RENNIE

DAT's THE BEGINNING

First digital audio tape player appears

The birth of the consumer usable DAT player has proven to be a difficult one. Mary Rennie sees just a glimmer of light at the end of the tunnel . . .

While the general consumer is still denied the opportunity to buy a digital audio tape player, several products aimed at the professional market are available in Australia. The DA-50 is the latest and lightest one from Tascam, the professional division of TEAC.

Because of the delays in getting to market in Australia, Europe and America, the commercial viability of DAT has been called into question. But with the continued absence of recordable compact discs there is a need for a recordable digital audio medium. If the DAT player didn't already exist it would need to be invented.

The DAT player has the ability to make copies ad infinitum with no deterioration in sound quality. So the collective purveyors of recorded music have ganged up on the DAT player. Such organisations, among them the Recording Industry Association of America, have threatened to file suit if DAT players reach their shining shores.

With American law placing the responsibility on the manufacturer of a product capable of being used illegally, the manufacturers of DAT have shown compliance and held off from selling DAT to the public everywhere but in Japan.

Sullied

Even those players available in Japon (and soon in Australia) are sullied by these circumstances. You can't record digitally from a CD player with these consumer players. The new Tascam DA-50 conforms to this practice. It offers three sampling frequencies: a 48 kHz play/record, 44.1 kHz play and 32 kHz play/record. The last of these frequencies, 32 kHz, is there for future digital satellite broadcasts. The 48 kHz frequency allows you to record in *analogue* or to create your own digital tape — with the appropriate recording instruments (digital mics, etc). The 44.1 kHz sampling frequency (the same one used for CD technology) will play prerecorded digital audio tapes.

Both DATs and CDs are recorded with the 44.1 kHz sampling so that there is no need to vary the master recording for the different media.

The DA-50 also incorporates the TEAC ZD Circuit (See Sound Insights April '88) to improve analogue-to-digital conversion and vice versa. The D/A stage is 2-times oversampled, the A/D stage is 1/2-times decimated. It has a mains driven remote control unit.

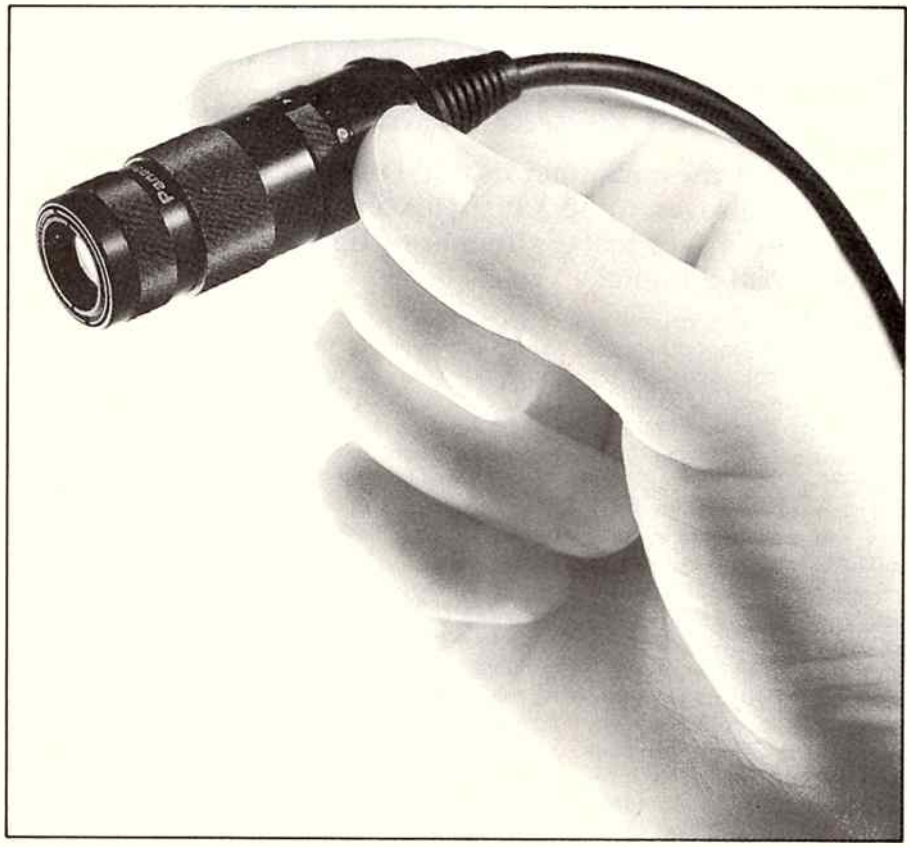
Frequency response is claimed to be 1 to 22 kHz (±0.5 dB) at sampling frequency of 48 kHz. Other advantages of DAT are complete lack of background noise, absence of wow and flutter and quick, but not instant, fast forward and reverse. Other features which one associates with a CD player, not a conventional tape player, including renumber, blank search, intro scan are here. The DA-50 is $3995.

Sony and Akai also have DAT players available in Australia for professional applications. Consumer model DAT players are supposed to be being released onto the Australian market early this year.

VIDEO CAMERA INNOVATIONS

Miniscule, underwater and nocturnal

There have been some innovations on the video camera scene. Here are three samples worth a second glance.



Tiny

The Panasonic WV-CD1 Colour Micro-Camera weighs only 20 g, measures only 17 mm in diamater and less than 50 mm in length. It is used in conjunction with a control unit up to 10 metres away, connected by cable. The tiny camera uses a 12 mm CCD (charge coupled device) pick-up device. Horizontal resolution is claimed to be more than 330 lines and signal-to-noise ratio is 44 dB.

High quality colour images are possible in light as low as 15 lux and a small diamater wide angle lens captures images as close as 20 mm. Colour changes are sensed instantly and compensated for, then proper white balance is obtained via the built-in auto-tracing white balance (ATW) circuit. White-balance and R and B colour can be adjusted manually too.

The camera head can be used with most existing camera systems or many ultra compact cameras can be integrated. The WV-CD1 can be connected to a time lapse, video printer or floppy disk recorder.

The camera is aimed mainly at industry for possible uses such as for checking completed PCBs, varied internal inspections, filming and observation of hazardous areas, even for filming sporting events (when the official rights haven't been granted!).

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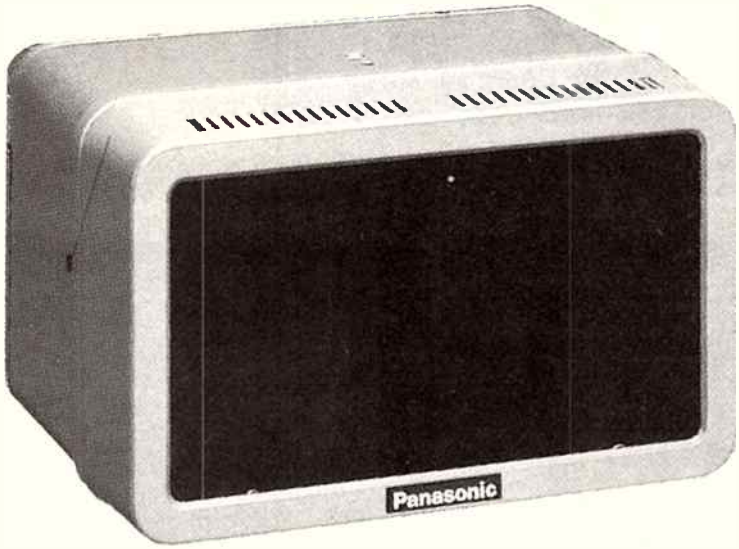

Sees in the dark

These camera people aren't really trying, you say. Witness infrared cameras that operate in complete darkness. The WV-CD810, for indoor use, and the WV-CD820, for outdoor use, even have a filter that cuts out visible light (it spoils your pictures).

Unfortunately for voyeurs, infrared rays are reflected off window panes. All these cameras are distributed by GEC Video Systems, 2 Giffnock Avenue, North Ryde 2113, ☎ (02) 887-6222.

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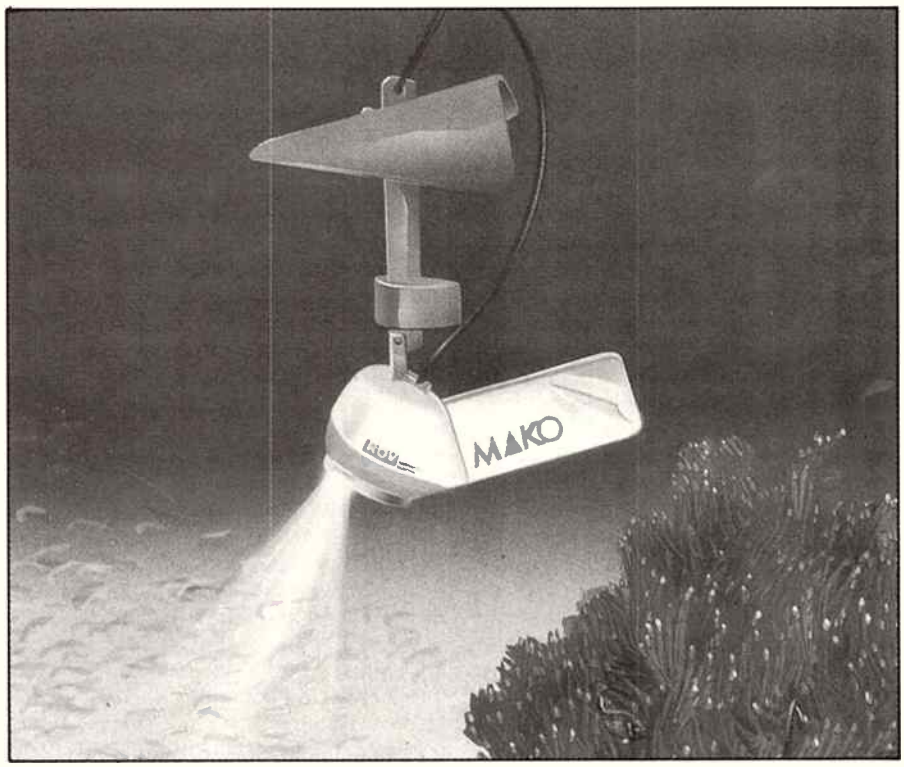

Underwater

Don't like getting wet but fancy yourself as a bit of a Jacques Cousteau? Mako has released an undersea scanner, an ROV (remotely operated vehicle) which can be connected to a video recorder. This low-light, capable, winch-driven, 12 V or 24 V powered, colour CCD camera is also said to be of interest to fishermen and water academics.

READER INFO No. 295

NATURAL SOUND

Yamaha's AVX-100 stereo amplifier

One wonders sometimes how many features can be included in a single, consumer electronics component these days. Les Cardilini dissects such a product.

If you were to make up a shopping list for a stereo-video surround sound control centre at home you would possibly find that most of the facilities and preferred options on your list, plus a few more, are included in Yamaha's new flagship Natural Sound Stereo Amplifier Model AVX-100.

I can remember having similar thoughts a few years ago when, coincidentally, another Yamaha innovation, the R-100 Receiver appeared here, equipped with a powerful stereo amplifier, pushbutton stereo tuner, programmable graphics equaliser and other digital facilities which, at the time, seemed ahead of their time.

It is not that each feature in itself seemed so remarkable, then, but rather that they were all able to be assembled together in a single, component sized package. And, now, here we go again.

The Yamaha AVX-100 comprises: four power amplifiers; an eight-mode surround sound processor, including a Dolby surround sound mode for suitably recorded soundtracks on disc and video movies; a video enhancer to improve picture quality in both the record and play modes; and a title edit function for dubbing or inserting your own sub-titles onto video recordings and home videomovies.

As well, the AVX-100 has provision for ten stereo audio and six video inputs. Any of them may be selected individually, for recording or playing in conjunction with each other, in a totally integrated home stereo/video system.

For example, the sound from any one of up to ten components connected to the AVX-100 can be selected to play with the picture from any one of its six video inputs. Conversely, the stereo sound from any input can be directed to any other device in the system with recording facilities, such as a VCR or tape deck. It thus becomes a very simple matter to re-record sound and video programmes, edit and dub sound tracks onto video, and play background music with otherwise silent tapes.

Use of simulcast

Another scenario which is readily handled by the AVX-100 is the reception of a TV programme which has its sound simulcasted on an FM stereo radio station. By selecting the sound from the FM tuner and the picture from the TV set the switch to simulcast is accomplished in just a few seconds; and when that show is over you can turn back to normal TV viewing or hi-fi listening, with the same ease. In fact, since the majority of the AVX-100 controls are duplicated on the system's infra red remote control most switching operations can be carried out from the comfort of your favourite armchair.

The ability to control the AVX-100 from the viewing or listening position is also useful and indeed very practical when adjusting the relative volume of the front and rear speakers for surround sound. The alternative of trying to set up a pleasing sound field, using the controls on the amplifier, then returning to your seat to assess the situation and repeating the exercise until it is right, could be quite a hit and miss affair and frustrating, to say the least. In fact, the show could be over before you finish twiddling. Both, the overall volume and the balance between front and rear speakers can be adjusted at the AVX-100 remote control and the sound field can thus be trimmed quickly and accurately from the listening position.

'. . . switching operations can be carried out from the comfort of your favourite armchair'

But it is not always necessary to use advanced technology to make life a little easier. One of the inputs to the AVX-100 thoughtfully has been mounted on the front of the amplifier.Anyone who has had to wrestle with a nest of cords and a mirror behind a stereo amplifier to hastily connect, say, a friend's VCR to do a spot of dubbing will appreciate the convenience of having auxiliary video and sound input connector sockets available at the front of the set. Also, the left and right audio inputs on the front of the AVX-100 are configured to automatically direct sound into both left and right channels in the stereo system when a single mono source is plugged into the auxiliary, left channel socket only; again, no fiddling with mono/stereo adaptor plugs or cords. When not in use the auxiliary inputs are concealed neatly behind a removable, rubber insert.

Four power amplifiers, a main pair rated at 65 watts and two at 14 watts continuous per channel are provided in the AVX-100. It is also possible to

bridge the two 14 watt channels to form a single, 28 watts channel, if required.

System configurations

Accordingly, a number of system configurations may be built around the AVX-100. The first and obvious choice is to utilise the four channels in the surround sound mode with speakers in front of, and behind or to the sides of the listening position. Alternatively, the bridged 14-watt amplifiers can be used to drive a single, centre channel speaker to stabilise centre-front sound images in larger installations, a technique used in cinema sound systems and provided for in the AVX-100.

An enhanced centre channel output is provided in the AVX-100 and is readily strapped, or linked, at the back of the set, into the 28-watt bridged amplifier pair. This of course releases the rear channel outputs which can then be connected into an external stereo amplifier (don't sell your old amplifier) to drive rear speakers. This configuration creates a five-channel, theatre-style sound field, set up by a left and right front stereo pair, a centre channel and two rear, or side, surround channels. A further option would be to settle for just two primary front channels and dedicate the centre channel to a sub-woofer to take greater advantage of the bass extension feature included in the AVX-100.

The AVX-100's digital surround sound processor has eight preset basic modes but each can be varied to suit a particular installation or listener's taste. Each mode provides a preset mix of reverberative sound, time delays and balance of front and surround sound to create different impressions of space or room volume. One of the eight modes can synthesise a stereo-like sound from mono sources while another creates a simple hall effect to simulate surround

sound from otherwise dry stereo programmes.

The Dolby stereo mode, of course, delivers fully decoded surround sound from suitably encoded soundtracks on videotape and disc recordings so it might be possible to recover front left and right stereo channels, a centre channel and a time delayed surround sound, or audience participation, channel. The time delay in the surround sound speakers prevents the sound images from being pulled away from the video screen when similar sounds occur on and off screen, simultaneously. The surround channel time delay in each mode can be varied between zero and 30 mS to trim the surround effect for different rooms and conditions.

Master volume control

Separate volume controls are provided for the front, rear and centre channels in the AVX-100. Once the relative volume levels in the rear and centre channels have been established, however, the volume from the system as a whole is subservient to the master volume control, which can be operated manually or via the infrared remote control which signals a small motor coupled to the volume control in the main unit. A muting function which drops the system volume by 20 dB can also be operated from either the remote handset or at the amplifier.

A light emitting diode (LED) bar is illuminated behind the index mark on the motorised volume control knob so that one can see the current master volume control setting from the listening position in the room. Similar LED indicators announce the selected inputs and outputs and show when the 20 dB muting is activated. The single, stereo headphone socket on the AVX-100 for private listening is normalled to the loudspeaker system, and the headphone level is controlled by the master volume control either directly or via the system remote control.

Three tone controls on the front panel of the AVX-100 respectively provide cut or boost in the bass, mid-range and treble frequencies.

Video and accompanying stereo sound inputs and outputs are provided, for two VCRs, a TV tuner, a CD Video/Laservision player, a CD-Video player and, of course the auxiliary input mentioned earlier. Stereo audio inputs and outputs are also included for two tape decks, a radio tuner and turntable. In all, these comprise the six video and ten audio I/O interfaces to the AVX-100.

In its video modes of operation, the

THE SYSTEM *Compact Hi-Fi From A Compact Hi-Fi*

Styled by Reinhold Weiss Design in the United States, the Proton AI-3000 Music System is streamlined, compact and ideal for the listener who is short on room space.

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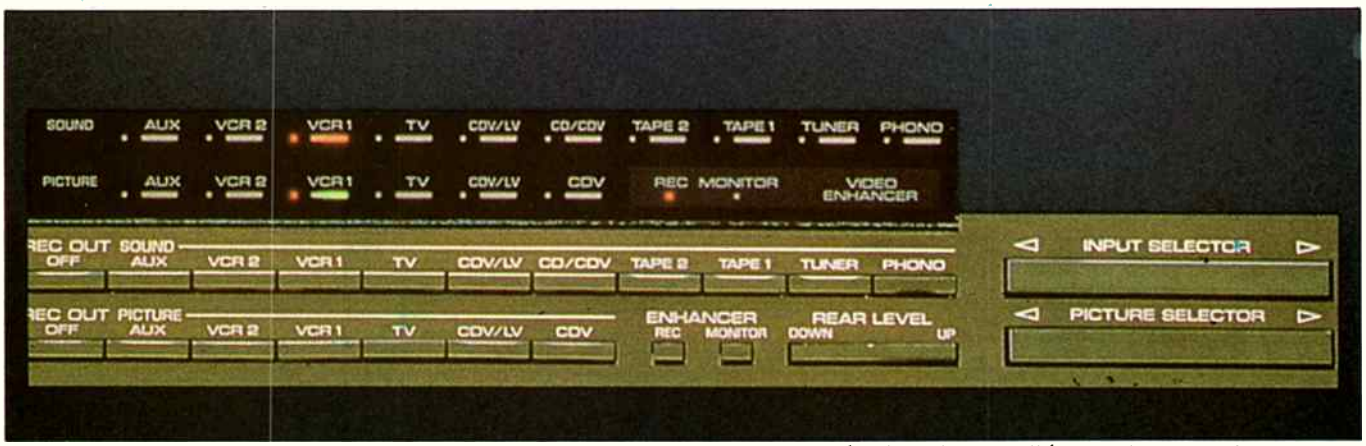


The input/output control board on the AVX-100. If you can afford the gadgets to plug in to it you will have quite a sound system.

AVX-100 has a superimposition function. This displays on the video screen the present status of the system, such as which inputs and outputs are active, the mode of the enhancer or surround sound processor as well as the current time delay. The display will also graphically illustrate the relative volume level in the rear channels and whether the 20 dB muting is on. The superimposed display can be called up indefinitely on the screen or simply flashed up for a few seconds.

Title editing

The title editing feature can be invoked during video recording and dubbing modes, to create up to three lines of sub-title characters for recording or dubbing onto videotapes. Each line may contain up to 24 characters and there are 111 characters, in all, to choose from. The title edit mode is entered simply by holding down a button for two seconds, after which time the surround sound buttons are reassigned title edit functions for selecting characters, choosing their size and shape and moving them around the screen prior to recording them on videotape as headers or visual comment.

As a further aid to improving the presentation of video programmes the AVX-100 has an inbuilt video enhancer which can be used in both the video recording and playback modes and with video cameras, to sharpen up pictures and improve detail in video programmes. The video enhancer *forecasts* a change in the luminance signal and adds reverse emphasis before and after the change to enhance the sharpness and clarity of borders between light and dark images.

Most functions on the front panel of the AVX-100 are also duplicated in the cordless infra red remote control, including the power ON/OFF switching. A switched, 240 Vac outlet on the back of the AVX-100 can be used to power other components in the system, under the primary control of the power switch in the set or via its remote control. As well, other Yamaha products in the RS compatible range of tuners, compact disc and CDV players, cassette decks and turntables will respond to general operating commands from the AVX-100 remote control in the same system, according to Yamaha. Functional controls on the remote control are grouped for easy recognition and access. All surround sound functions including rear speaker and overall system volume level, modes and time delays can be controlled from the RS-AVX100 remote control.

'. . . it is not always necessary to use advanced technology to make life a little easier'

Summing up

Despite its many features and number of buttons and controls, the AVX-100 is not pretentious in appearance and with a little practice and familiarisation is easy to operate. The input and output selector buttons are neatly arranged in rows and LED indicators near each button confirm the various operations and modes selected.

There is a pleasing consistency to the feel of the many pushbuttons on the set. This extends through to the remote control, where a slightly heavier action protects the buttons from operating accidentally should the remote be mishandled or placed down keys first - within reason.

The handbook which comes with the set has generous explanations and diagrammes of the various modes and operations. Novices endeavouring to use the title edit and enhancer functions will find it invaluable.

Recommended retail price for the AVX-100 is $1299.

Further information about the Yamaha natural sound stereo amplifier model AVX-100 can be obtained from Yamaha Music Australia, 17 Market Street, South Melbourne 3205. ☎ (03) 699 2388.

The Adcom GTP500.

With the new year truly bedded in, Henk H. van Zuilekom looks back on those products we turned on or turned us on in the past year.

THE YEAR IN REVIEW

. . . and a sound year it was

Adcom's GTP 500 tuner/preamp

For the most discriminating audiophiles, pockaging the tuner and the preamp into a neat single box without the amp has some real merits especially since amplifiers generate considerable heat which can disturb the specifications of the tuner. This really becomes an issue with a sensitive tuner like this.

The designers may have intended this unit be used with one of their three matching amplifiers but, as I found, it could readily be used with any quality amp to achieve exceptional results.

The frequency response at the NORMAL output for an input on the CD terminals is 3 dB down at 1.8 Hz and 240 kHz. This is well within the -0.1 dB quoted for 20 Hz and 20 kHz in the manufacturer's literature.

Louis Challis
ETI January 88. p SI15

Eurovox Model MCC-8280E

There can be no denial that the top-of-the-line Eurovox radio cassette incorporates more into a standard DIN package than it would have been thought possible. A large number of pre-programmed displays can be selected and viewed. It incorporates security coding as well as a multitude of multi-function microcontrolled buttons. It also sounds fantastic.

The frequency response of the amplifier is -3 dB at 30 Hz and 16 kHz. The signal to noise ratio is -68 dB(A) cf 12.25 watts output. The tone controls provide cut and boost at each of the six frequencies of 60, 150, 400, 1k, 2.2k, 5k and 12k whilst the loudness control provides a real loudness control type performance with typically +10 dB boost at 70 Hz and 7 dB of boost at 10 kHz.

The cassette recorder is also extremely good as it provides replay response which is 3 dB down at 48 Hz and 9 kHz on type 1 ferric oxide tape and 3 dB at 46 Hz and 10 kHz for the type 2 chromium dioxide tape.

Louis Challis
ETI February 88. p SI12

Dali 40s.

Dali 40 hi-fi speakers

Dali speakers are undoubtedly the most interesting to be produced during the 80s. They weigh 68 kg and come with braced black aluminium corners to im-

Eurovox Model MCC-8280E.

prove cabinet stiffness. The woofers have four layer copper voice coils with a ceramic magnet assembly and are exceptionally efficient. The midrange drivers have been extended out to increase radiation efficiency.

They will, with a price tag of $7990 per pair, have a more limited market than they deserve but they are still the most outstanding speakers Dali has produced and I venture to say one of the best, if not the best, speakers currently manufactured in Denmark.

Louis Challis
ETI March 88. p SI16

Pioneer CLD 1050 multi system

Compact Disc Video (CDV) has at last arrived with the recent release of Pioneer's Laser Disc/Compact Disc/Compact Disc Video player. The latest offering from Pioneer combines both sound and vision.

The player automatically handles all disc versions and sizes in the PAL LaserVision system as well as regular CDs and CDV recordings.

This player should be readily accommodated in home systems where there is a UHF TV set. As well, of course, the sound from the CDL 1050 may be connected to a stereo amplifier and speakers.

Les Cardilini
(ETI April 88. p SI9)

Hertz linear 6.2

This amplifier is the first imported high performance amp we have seen from Germany. It is, in many respects, a different unit than the ones with which we have become familiar in either the hi-fi or PA fields.

The objective testing of this product provided considerable data, some of which did not necessarily agree with the manufacturer's published literature.

The one obvious variation related to the low-pass cut-off frequencies of the amplifier, which our testing showed to be 25Hz for 3 dB down and 61 Hz for 3 dB down, for filter-out and filter-in respectively.

A rugged and potent amplifier, it should attract many intending purchasers because of its simple, neat, effective performance and sensibly designed output circuitry.

Louis Challis
(ETI April 88. p SI15)

Pioneer S-55T speakers

The S-55T is markedly different from the previous Pioneer speakers in that it would appear their designers are starting to learn from some of their competitors in England, Germany and Japan. Through this, they are now incorporating features which really does put them on par with, and in some respects in advance of, many of their local competitors.

Pioneer's revolutionary S-55T.

The S-55T speaker system is small and best described as a bookshelf system. The speaker line-up is unusual with a pair of 140 mm diameter low frequency drivers vertically aligned on the face of the cabinet flanking a central 25 mm diameter ceramic carbon dome tweeter.

These speakers produce superb classical music, excellent pop and almost realistic rock.

Making the effort to hear these speakers will be well worth the trouble.

Louis Challis
(ETI June 88. p SI12)

The Yamaha CDX-1110

Yamaha really set some of their competitors on their ear with the release of their new *Hi-Bit* CD players.

Yamaha were among the first of the CD manufacturers to introduce the concept of a *quadruple over-sampling* system which raised the standard 44.1 kHz sampling frequency (which everybody thought was etched in blood) to a frequency of 176.4 kHz.

Not satisfied with the performance that CD player provided, Yamaha went one further and offered eight times over-sampling, i.e: a sampling frequency of 352.8 kHz. This extremely high frequency facilitates an even wider filtering separation zone created between the top of the audio-signal spectrum and the sampling frequency which is almost in the medium frequency radio transmission band.

The characteristics of the CDX-1110 are close enough to perfect to warrant no further comment, while the signal to noise ratio performance of this CD

player without emphasis is excellent in the left channel and truly outstanding in the right, providing 114.1 dB(A) without emphasis and 120 dB(a) with emphasis. This order of performance puts it marginally in front of the Micro Seiki, which I had previously regarded as the yardstick for comparison.

These signal to noise figures are unquestionably the best figures we have yet recorded and will prove particularly hard to beat.

Louis Challis
ETI July 88. p SI20

Tannoy Eclipse speakers

The Eclipse is a two-way speaker system and incorporates a relatively small 165 mm diameter mid-range bass driver and a 28 mm diameter polyamide diaphragm tweeter in a remarkably small cabinet with a volume of only 11 litres which is less than 0.4 cubic feet.

The most striking objective is its frequency response, which is flat all the way from 150 Hz to 18 kHz. There is a modest 9 dB droop in the 80 Hz to 120 Hz region with another shallow threshold in the response before rolling off again at 45 Hz. The low frequency output characteristics, measured under anachoic conditions, confirmed how much trouble the Tannoy design group has taken to minimise the limitations in their previous series of consumer speakers.

They will add lustre to the Tannoy name and pleasure to your listening, especially when utilised in those space-limiting situations such as bookshelves and small rooms.

Louis Challis
ETI August 88. p SI18

Celestion SL700 speakers

The SL700 is a very unusual speaker system which owes much of its early developmental work to some very innovative research at the British Atomic Energy Commission in the late 70s.

Each cabinet incorporates the latest developmental versions of what appear to be two refined and technically advanced conventional drivers. The dome tweeters, in particular, utilise a lightweight aluminium dome which is apparently the same driver Celestion now uses in its SL6S speaker system. This tweeter has been consistently refined over the past five years to the point where it offers excellent performance.

My overall impressions of this system is that they are capable of providing remarkable fidelity at modest listening levels as these speakers perform admirably at high listening levels with frequency content above 50 Hz and appear to be primarily designed for classical music, as opposed to rock and pop.

Louis Challis
ETI September 88. p SI12

The Tannoy Eclipse.

Part of Jamo's new range of speakers.

Art for sound's sake

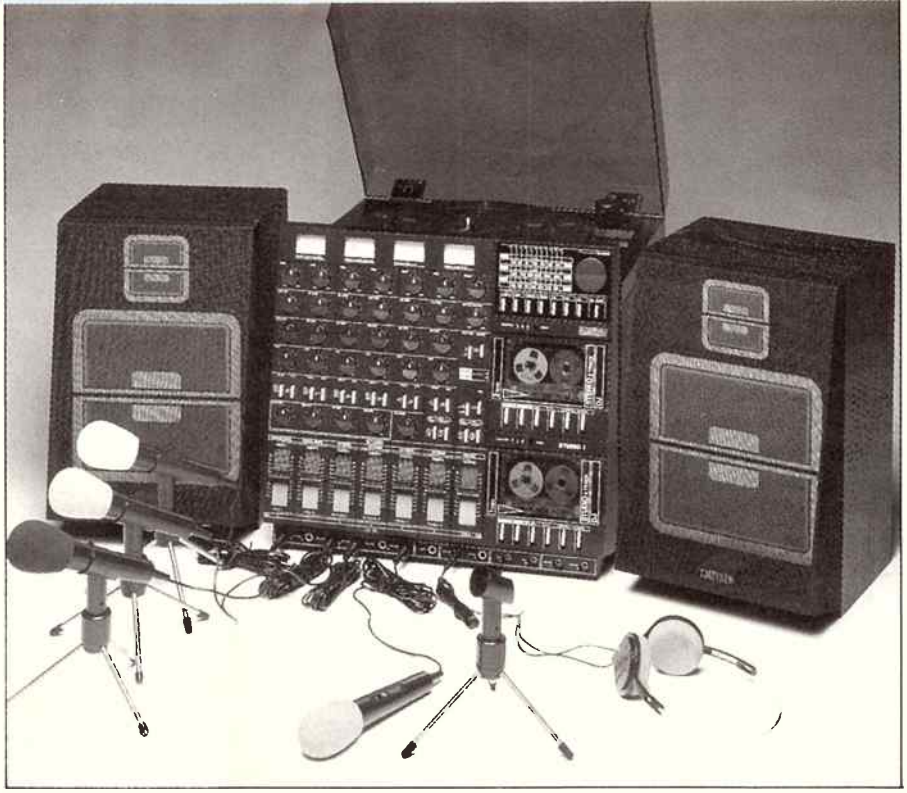
Among the release of a new speaker range from Jamo, the most interesting one is undoubtedly the Art.

Jamo's Art is a small flat speaker that hangs on the wall, about the size of a record cover (350 mm x 400 mm) and looks even slimmer than its 90 mm. This speaker *must* be fixed to the wall since its bass reflex port is at the rear and the wall itself becomes an integral part of the sound-producing complex.

These small, slim speakers which house a 25 mm wide-dispersion tacile dome tweeter and a 130 mm rubber roll surround woofer are capable of matching the base output of much larger floor-standing models.

With a recommended retail tag of $750 it offers an excellent compromise for people who can't have speaker boxes cluttering up their floor space.

Pat Hayes
ETI October 88. p SI16



The Amstrad 100: knobs, knobs and more knobs.

Amstrad Studio 100

The unit is housed in a black plastic enclosure and contains a belt driven turntable, tuner, stereo amplifier, two casette decks, power amplifier, preamp with tone controls, six mixing channels and four recording channels, mics, headphones and two loudspeakers.

The sound quality is reasonable, but hardly hi-fi in the accepted sense. The trade off is the three in one application together with a price tag of less than $1000. If you are interested in getting into serious musical recording, the Amstrad 100 is a great way to start.

Terry Kee
ETI October 1988. p SI8

B and W 801 M series speakers

The M series is a development of the 801 F series, previously regarded by many as the best speakers in the world. The size and shape have changed slightly, a self powered protection ciruit added, and the terminals repositioned.

Inside there are more changes. The tweeter is new, as is the crossover circuit. The results are worthwhile improvements in low end frequency response, phase response and in its response to tone burst. Subjectively, there are slight but audible improvements as well.

At a price of $8000 a pair, most people will not be able to buy them but even if you can't, go into the shop and have a listen to what audio perfection is all about.

Louis Challis
ETI November 88. p SI12

Proton AI-3000

It's an FM/AM tuner, amplifier, casette player and CD player all in one box, with a pair of external speakers. The speakers are small cheap and nasty, and so we didn't even test them, but the rest of the unit is first rate. FM stereo response is ruler flat from 10 Hz to 10 kHz, dropping by only one decibel at 15 kHz. To compensate, AM response is diabolical, with 3 dB points at 50 Hz and 2.6 kHz. The casette deck reproduces 13 Hz to 15 kHz with type 11 tape, and wow and flutter are reasonably low. The CD player is excellent.

Subjectively, much depends on the speakers one uses. I used B and W 801 Fs, and the unit functioned extremely well. The amplifier will deliver its full rated power without any distortion, and the FM tuner has adequate sensitivity to pick up all local FM stations.

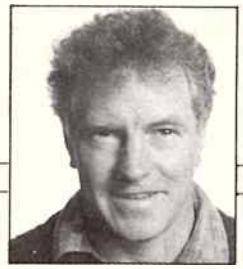
Louis Challis
ETI December 88. p SI8

Pioneer CDX-M100

This designed-for-the car CD player mounts safely out of sight in the boot. It accepts up to six compact discs loaded into a magazine and is controlled by a unit mounted in the dash. This unit, the KEX M700, is an AM/FM clock radio.

It has a number of features, of which probably the most interesting is the automatic station search function. This will lock on to the six most powerful stations in the reception area, and can then be recalled by hitting a single button. The same facility can be used to call up discs in the magazine.

Les Cardilini
ETI December 88. p SI20



ANTHONY O'GRADY

CD Reviews

YES

TALES FROM TOPOGRAPHIC OCEANS

(Atlantic)
Cat. No. 781325-2

As record companies assiduously re-release their back catalogues on CD, it is not always a pleasure to rediscover the treasures of a musically involved youth. In '73 for example, when the singles charts were topped with saccarine such as Tony Orlando's Tie A Yellow Ribbon Around The Old Oak Tree and Donny Osmond's The Puppy Song, "real music" people were buying Yes' Tales Of Topographic Oceans.

Fifteen years later, the doubts of re-evaluation begin with singer Jon Anderson's liner notes: "We were in Tokyo and I had a few minutes to myself in the hotel room before the evening's concert. Leafing through Paramhansa Yoganda's *Autobiography Of A Yogi*, I got caught up in the lengthy footnote on page 83. It described the four part shastric scriptures which cover all aspects of religion and social life as well as fields like medicine and music, art and architecture . . ."

Those were the days my friend, when spiritual enlightenment could be measured in rpms, when an album could top the charts without radio play, when music was a lifestyle not just a recreation.

Today the four "movements" that make up Topographic Oceans have such little relevance to contemporary music parlance, oftentimes it seems you are listening to a timewarp.

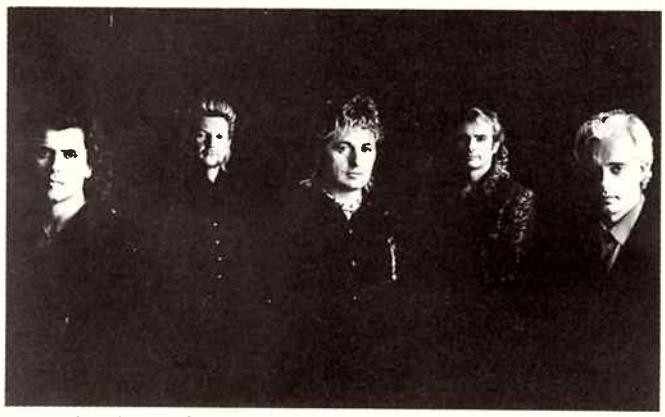
Many of the problems are technological. In 1973, Yes were state of the art — but today, the shrill thin sounds from Rick Wakeman's keyboards seem ludicrously inappropriate while Alan White's drum technique of around the kit in 80 hits not only clutters the music without providing a solid rhythmic basis, by comparison with modern studio sounds, he could be beating pillows with a rubber mallet.

Yet, in 1973, White's combination with bassist Chris Squire to provide a form of rhythm as a lead melody was considered a dramatic breakthrough in the dynamics of rock music.

The one component of Topographic Oceans that sounds palatable today is the work of guitarist Steve Howe, a technician capable of both power and subtlety. Unfortunately for the long term prospects of Tales of Topographic Oceans, his work is too often submerged into the clatter of his cohorts.

In Yes' early days, singer Jon Anderson had the unique ability to blast through a rock melody while maintaining the vocal purity of a choir boy, but his reverence for the weighty themes embodied in Topographic Oceans sees him striving for ethereality, and achieving sanctimony.

Which is not to say all progressive rock from the year 1973 has aged so disappointingly. Pink Floyd's Dark Side Of The Moon for example entered world charts the same year, and is still in the US Top 200. But Floyd, for all their reputation as space cadets, utilised the enduring basis of the blues in their most popular works, while Yes, for all their earnest attempts in trying to expand the boundaries of rock now seem just as silly as Donny Osmond and The Puppy Song.



Yes in '87 (l. to r.) Rabin, Squire, Anderson, White and Kaye

CAL

SAILORS AND MERMAIDS

(Mercury)
Cat. No. 836 400-2

Cal is Mark Callaghan, former leading light of The Riptides, one of the few pub rock groups of the early 80s who could mix intelligent songs with a beery goodtime. He went on to form Gangajang, a band who proved the hit single format could also contain a classy song, viz, Gimme Some Lovin' and Sounds Of Then.

Now solo, Sailors And Mermaids is his most thought provoking and intensely lyrical work yet. The songs range from treatises on socialistic concerns such as Aboriginal land rights on Do It Rite (with Callaghan having the honesty to admit his position could be seen as being tokenistic), to strictly personal propositions such as Spooky which reconciles his Catholic sense of guilt of indulging in sinful pleasures, with his human hunger for a no-hassle good time.

Mark Callaghan

Musically the songs range from chunky no frills rock to fragile ballad structures, to eccentric rhythmic patterns that could almost be the mutant offspring of cajun zydeco and South Pacific reggae.

Sailors and Mermaids does not have the brash immediacy of The Riptides, or the fresh popiness of Gangajang. If there is a fault it's that there is little discernible band vibe here, a quality abundant in both — The Riptides and the Gang. But in terms of content, it is Callaghan's most rewarding work yet.

YAMAHA'S NEW CDX 1110 CD PLAYER OWES ITS BRILLIANCE TO A PIECE OF TWO-BIT TECHNOLOGY.

Until now, CD players were limited to 44.1 kHZ and 16 bit technology. Now Yamaha has, as Audio Magazine states, "found a way to improve on perfection". Introducing the world's finest CD player that features 18 shifting bits and 8 times oversampling digital filters. A technological progression that quadruples both sampling frequency and density to produce exquisite wave-form resolution.

The result is unsurpassed sound quality. We could mention its 44 key wireless remote control, its new 3 beam laser pick-up, its 24 track direct access and random access programmable playback. Or we could compare it to our previous model, the CDX 1100. Of which Audio Magazine said "As to how a CD player is ideally supposed to sound, we do not hesitate to say that it should sound like the CDX 1100". All of which proves that the new CDX 1110 won't sound one bit better than any other CD player. It'll sound two-bits better. Starting at $399, our entire CD player range is there for the picking in your local Yamaha Hi-Fi store.

YAMAHA

5 YEAR WARRANTY.

Saatchi YAM1044

READER INFO No. 38

12 month warranty on laser heads.

Temperatures▸

A complete range of temperature measurement kits is available from Zenology which cover a wide range of industry applications.

The kits contain selection of water and dust resistant digital thermometers, selected probes to suit the application and a shock-proof carry case to carry and protect the instrument and probes. Type K thermocouples are available and where high accuracy is needed platinum resistance sensors can be provided.

For those operators needing to measure temperature and relative humidity a new instrument kit can be provided combining both measurements in one accurate convenient instrument. More details ☎ (03) 232 0599

READER INFO No. 266

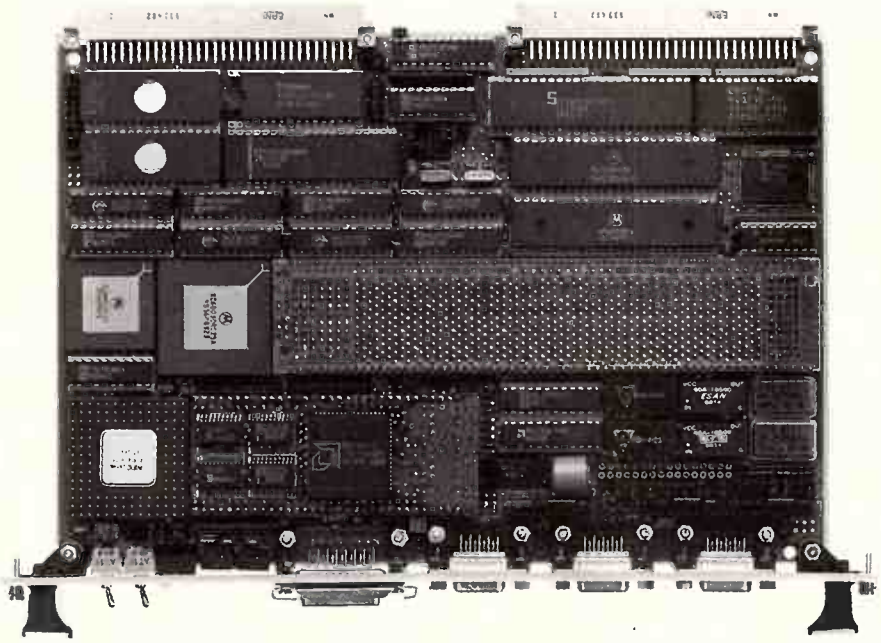
◂Phone safety

A telephone safety device has been developed by ABE computers to instantly earth a telephone connection in the event of a lightning strike or other stray voltages. The device equally protects phone receiver users and connected equipment such as Modems, Fax, Telex and Telephone answering machines.

A warning printed on page 1 and 8 in the A-K telephone book explains some of the dangers of direct telephone connections.

Meterologists tell us there are some 7,000 lightning strikes around the world every day. Prevention is better than cure. Details ☎ (03) 288 2144. READER INFO No. 267

Single board ▸ computer

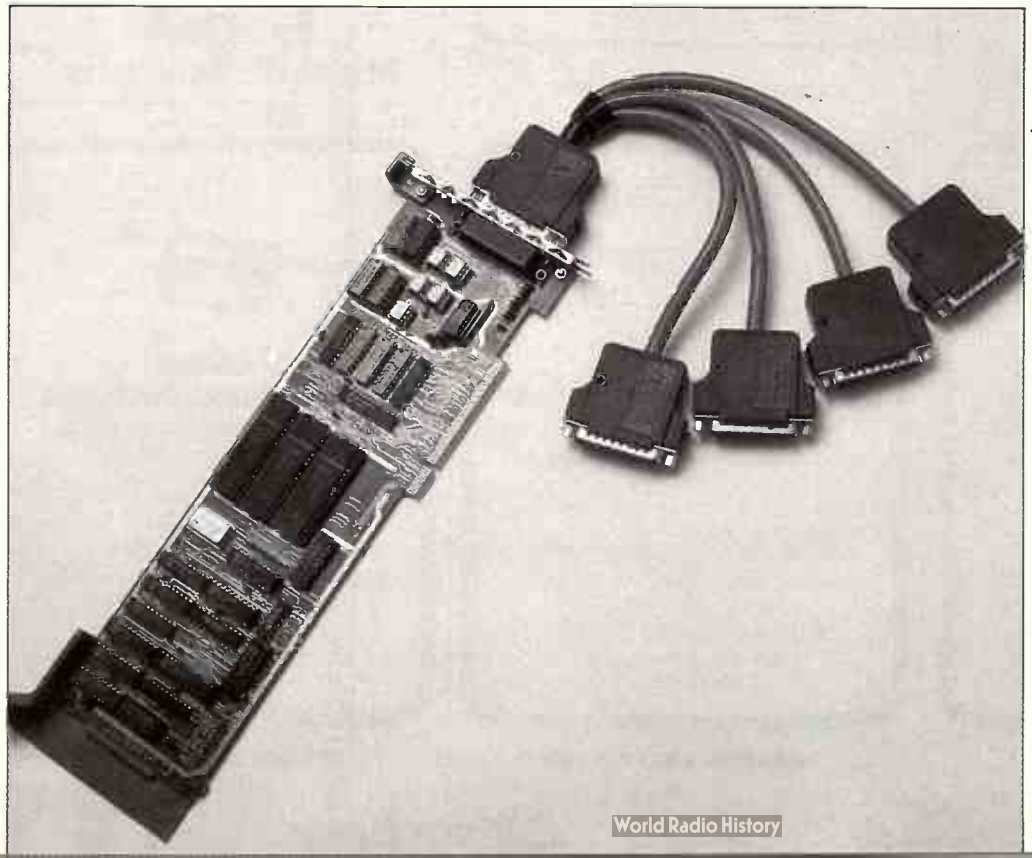


Force Computers has announced the SYS68K/CPU-37, a single board computer based on the 68030 and the VMEbus. The CPU-37 is the latest addition to the high performance VME/PLUS family of VMEbus based computer products from Force. Designed for stand-alone single board computer applications in the industrial environment, the CPU-37 provides both the hardware and the software to satisfy most real time application needs on one double eurocard.

The CPU-37 is supported by the real time kernel VME-PROM which is installed on the board as standard. VME-PROM provides not only a complete embedded real time kernel environment, but also provides a software interface for all the on-board I/O devices via fully implemented I/O device drivers and a complete debugging environment.

Find out more on ☎ (03) 873-4455.

READER INFO No. 268



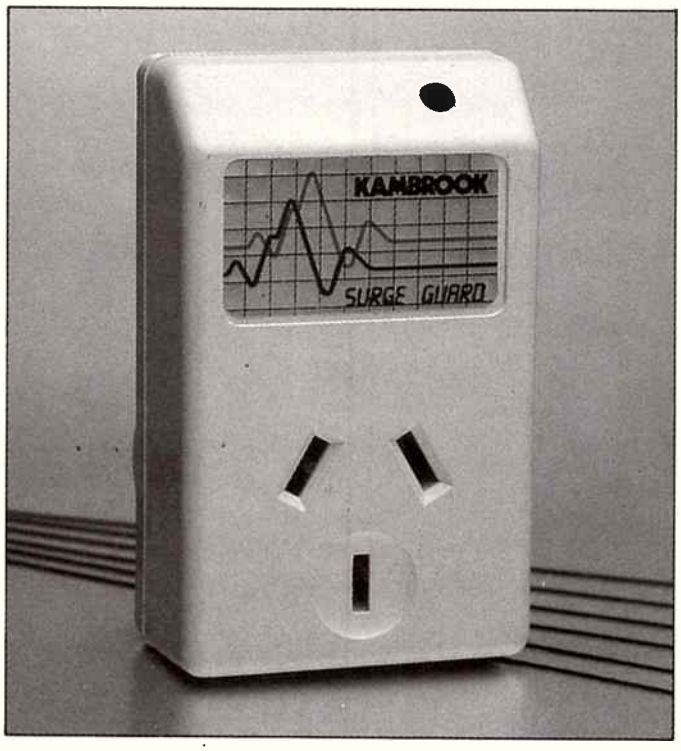
Micro channel ◂ board

Hypertec has added a new Micro Channel product to its PS/2 range. Dubbed Hyperport II, it provides serial and parallel ports for IBM PS/2 Models 50, 60, 70 and 80.

Hyperport II is available in two configurations providing one parallel and one serial port, and one parallel and three serial ports respectively.

Both boards are supplied with an adaptor description file which is read by the IBM PS/2 configuration program. ☎ (02) 816 1211

READER INFO No. 269



Surge guard ▲

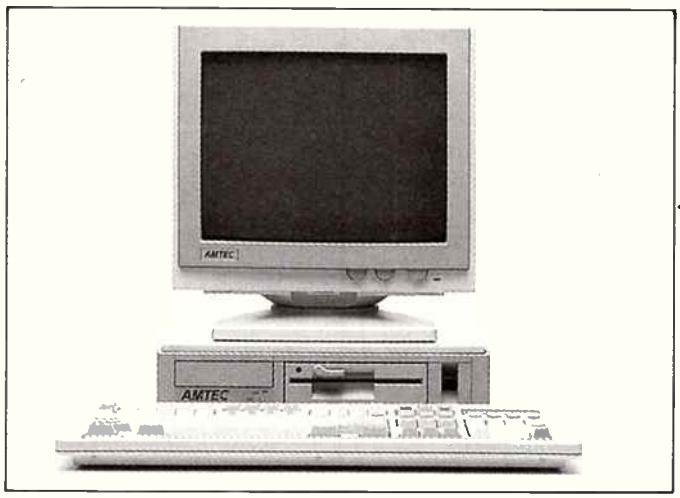
Kambrook has just released their new SGIO power surge guard into the Australian market place.

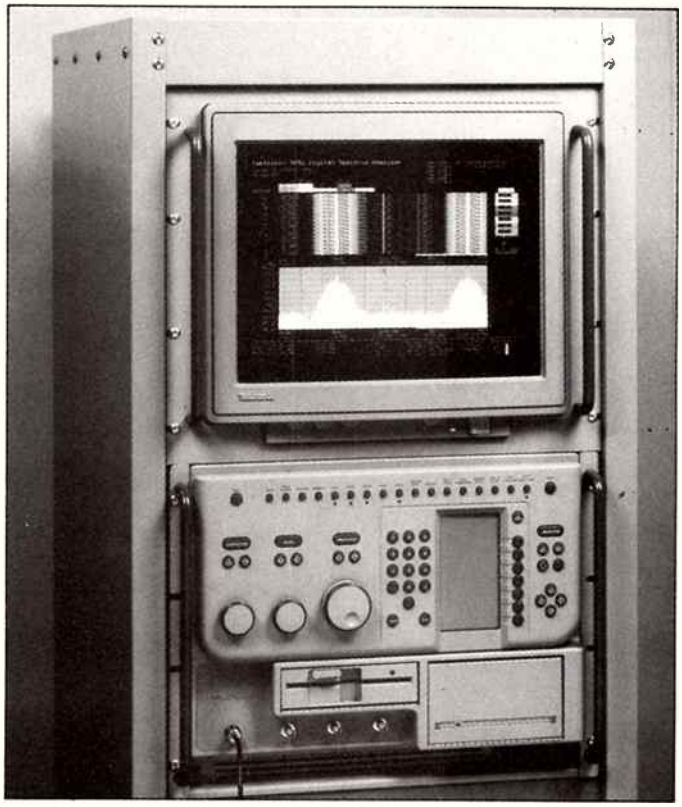
With the surge guard, you can protect valuable household electrical items, such as microwave ovens, televisions, computers, refrigerators, hi-fi equipment and video recorders from damaging power surges.

Power surges can be caused by industrial equipment such as electric motors, refrigeration and air conditioners being switched on and off, and voltage spikes.

The surge guard has a red neon indicator light that glows when the unit is operating. Orders ☎ (03) 543-2200.

READER INFO No. 270





Faster analysis ▲

The Strategic Project Unit of the Microwave Group at Tektronix has announced recent signal processing innovations that provide a nearly 100-fold speedup in real-time spectrum analysis along with 800-element span resolutions to 1.25 Hz. The core technology, essentially a bank of 1024 complex parallel digital filters, is central to the new 3052 Digital Spectrum Analyser. The 3052 uses this technology for a maximum 200 uS spectral output rates on signal bands to 10 MHz with continuous real-time spectral displays on bands to 2 MHz.

The new 2 MHz real-time and nearly real-time 10 MHz capabilities of the analyser significantly expands analysis power in numerous application areas. These include communication channel fault characterisation, laser testing, frequency monitoring or surveillance, high-throughput ATE, and many others. Details ☎ (02) 888-7066.

READER INFO No. 271

◂Networking Dart

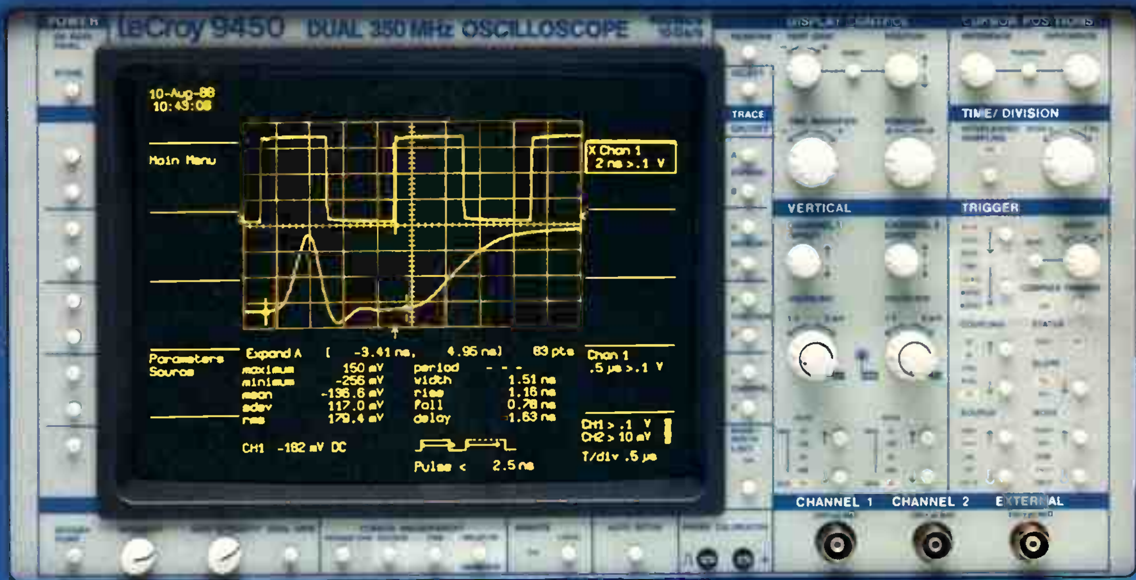
Computer Networks has announced the release of an Australian-designed and manufactured range of workstations called the Amtec Dart.

The range, consists of the Dart 88-10, the Dart 286-10, the Dart 286-16 and the Dart 386-20.

Apart from working under Novell, the Dart workstations can also be used on all major vendors' LANs, including 3Com, DEC-Net, Sun PC-NFS and IBM Token Ring networks. Details ☎ (02) 957-2420.

READER INFO No. 272

SPEED, FIDELITY and...
...UNPRECEDENTED TRIGGERING



FASTGLITCH trigger mode is used to trigger on a glitch 1.51 nsec wide which occurs before the leading edge of a 500 kHz clock signal (top trace, see trigger arrow at the bottom of the graticule). Fast sampling rates, automatic pulse parameters and horizontal expansion by 250 times (lower trace) all combine to reveal the signal details.

* 350 MHz Bandwidth, 400 Ms/s ADCs
* 50K Non-volatile Memory per Channel
* Glitch, Interval and Logic Trigger Modes
* Automatic Waveform Parameters

Until now, recording very high-frequency signals with digital oscilloscopes often meant giving up measurement fidelity, due to short acquisition memories, inadequate vertical resolution, or sometimes even both. NOT ANY MORE!!

With LeCroy's new 9450 you get it all, 350 MHz bandwidth, 400 megasample/sec digitizing rates, 8-bit vertical resolution (12-bit with averaging), 50,000 words of acquisition memory per channel and... a uniquely powerful trigger system.

Glitches, drop-outs, logic patterns and states are all triggered on easily with LeCroy's new and innovative FASTGLITCH, INTERVAL and LOGIC trigger modes.

*The 9450's massive memories show more pre- and post-trigger information so you can examine the cause and effect of any signal perturbation. Waveform expansion (up to 1000 times) reveals **ALL** the signal details you are looking for, and fast parameter calculations deliver the answers you need in a fraction of a second.*

*And... you already know how to use it. A familiar front panel, together with a push-button **AUTO SETUP** facility, lets you rapidly learn to operate this new member of the LeCroy oscilloscope family.*

ETPOXFORD 31 Hope Street Ermington NSW 2115 Telephone (02) 858 5122
214 Berkeley Street Carlton Vic 3053 Telephone (03) 347 0733

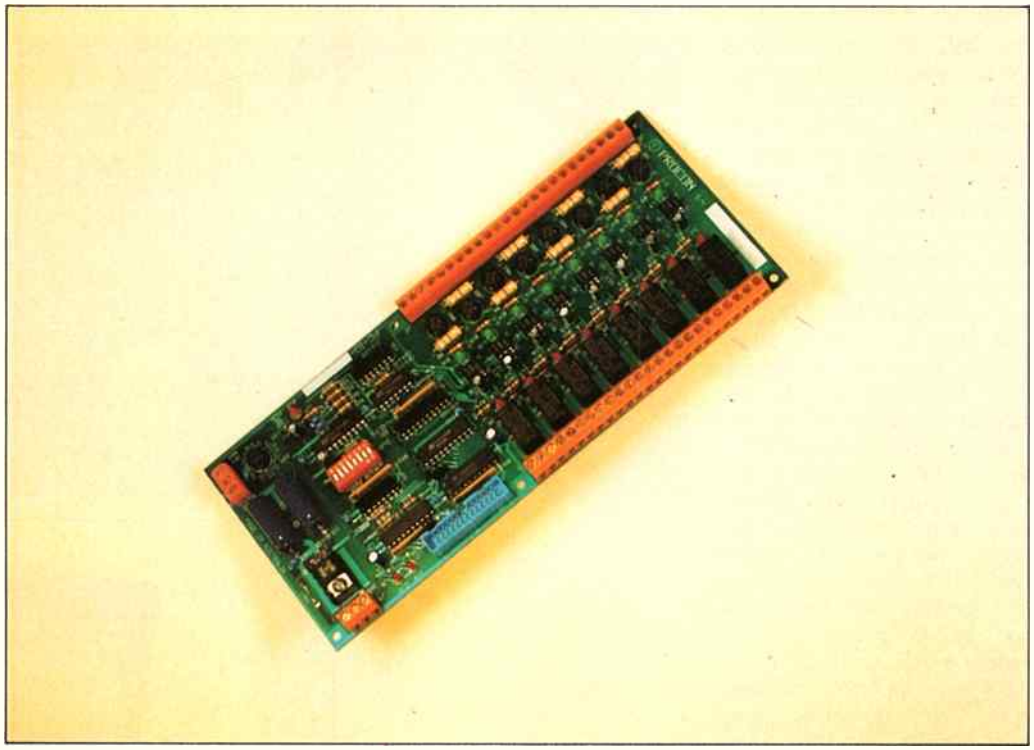
LeCroy

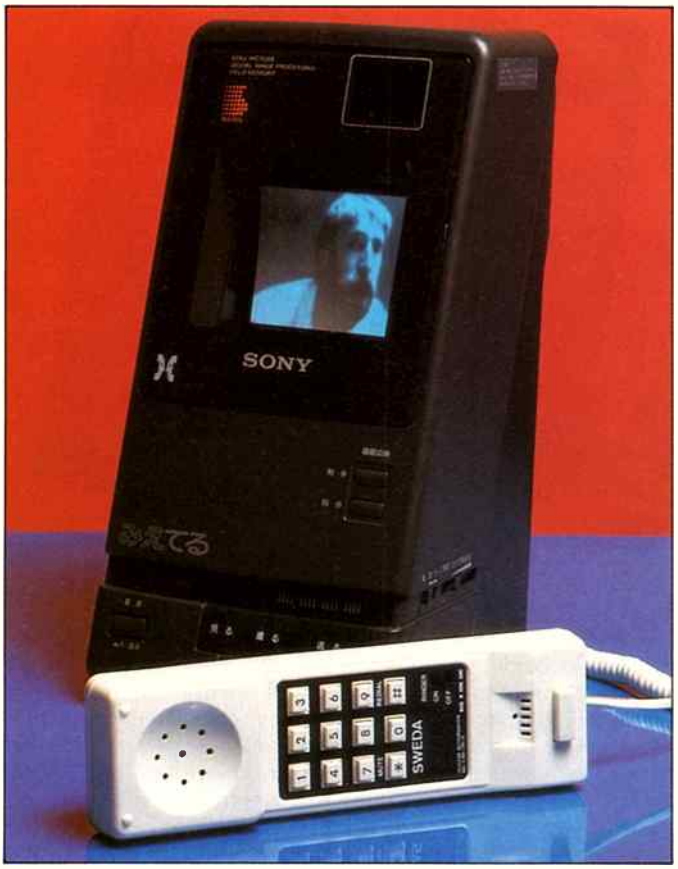
Innovators in Instrumentation

READER INFO No. 44

IBM-PC control board ▼

Procon Technology has released an externally mounted digital I/0 board for 'real-world' computer control application. The PC-10-NR provides eight optically coupled inputs and eight relay outputs on a board measuring 240 mm by 100 mm. The board is suitable for a mulitude of applications in industry, the home or school. These boards are capable of being daisy-chained to provide a total of 120 inputs and 120 outputs using a special 8 bit bi-directional card (PC-BD-10), also available from Procon Technology, inserted into a single card slot on any IBM-PC/XT/AT computer or compatible. Each PC-10-NR board comes complete with demonstration software and full instructions. Many input and output options are available. Further information: ☎ (03) 336-4956.





◀ Videophone arrives

Sony Corparation has released a videophone that works over the ordinary telephone network. The unit is not being released in this country. However, Sony has sent a couple of demonstration models to the local distributors for evaluation.

The unit is a desktop device with a small mono screen and a camera lens above. It is designed to be pluged into the existing phone cord, so instalation is really simple.

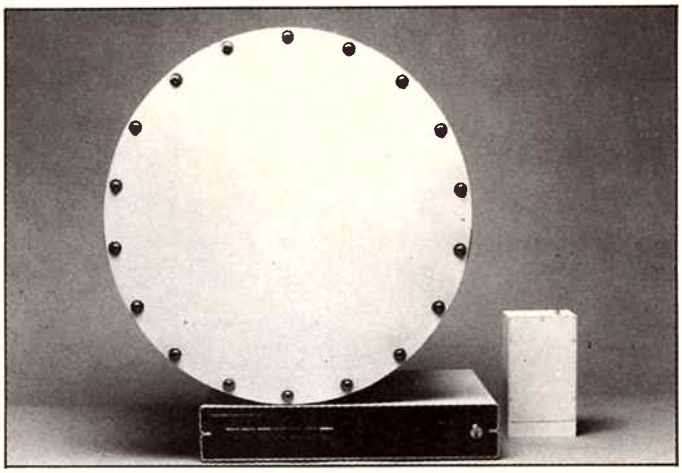
A picture is sent whenever a button on the front panel is pressed. Doing so cuts audio communications for about ten seconds.

The unit is equiped with two video stores, which permit the last picture sent, and received, to be stored. The user can select either for display.

The unit is probably not a practical consumer product. However, it does demonstrate the direction of domestic communications technology

READER INFO No. 296

Portable digital microwave link ▼



The DMC 23 from Mastatek is a narrowband digital microwave radio designed for operation by private users, common carriers, and government agencies in the 23 GHz frequency band. The DMC 23 provides short-haul point-to-point communications of voice and data at transmission rates of DS1, 4 x DS1, or DS2 offering capacity of up to 96 voice grade channel circuits. The DMC 23 can also support international digital rates of CEPT1, 4 x CEPT1 and CEPT2. Key systems features include: high system gain, high reliability, low power consumption, small size, user-selectable scrambling codes, loop back testing, built-in diagnostics and battery back-up. Typical applications include trunking, local area networks, spur route feeders, and local distribution. ☎ (03)233-6677.

READER INFO No. 275

Little caps

Crusader has just released a range of polyester surface mounted chip capacitors from Arcotronics Italia Spa. They are type numbered LDAC and produced in five case sizes.

End terminations are nickel plated with tin and lead alloy. Capacitance ranges from 10 n to 1 uF with tolerances of 5,10 or 20%. Nominal working voltage is 50 Vdc. Total self inductance is less than 5 nH. ☎ (02) 516 3855.

READER INFO No. 276

Bridging the bill ▲

The Callcentre Bridging System from Design 2000 allows selected staff to make local, STD & ISD telephone calls from any remote telephone and bill the cost of those calls to one designated number. A PIN number prevents unauthorised access, and having accessed Callcentre it is possible to make more calls without hanging up the remote telephone.

Callcentre can be plugged directly into two separate telephone line sockets. Alternatively, a telecom technician can wire two mode 3 sockets to which the unit is plugged into. Line 2 is the IN line, line 1 is the OUT line (calls are charged to line 1). The 9 Vac plug pack must be plugged into a 240 Vac outlet which is turned on. Call them ☎ (03) 758 5933.

READER INFO No. 277

Calculators ▲

Hewlett-Packard is adding three calculators to its lineup.

The HP-20S and HP-22S add to HP's offering of algebraic-entry calculators, while the HP-32S is designed for students who prefer RPN (Reverse Polish Notation) machines. RPN is HP's traditional entry system that makes calculating and programming easier by requiring fewer keystrokes than algebraic entry. More answers ☎ (03) 895 2895

READER INFO No. 278

It's all there

One of the biggest headaches confronting many firms these days is keeping abreast of the growing amount of information available. It can be an expensive and time-consuming problem, but keeping up is essential for the survival of any competitive business.

The latest release of the Australian Electronics Directory is designed to take the time-consuming research out of information gathering.

The data system includes two annually—produced directories which are compiled by professional engineers. Both directories are designed to drive a microfiche data system, and the information stored is regularly updated. A postcard size microfiche can hold up to 98 pages of detailed technical information.

The entire system consists of the microfiche data, a microfiche reader, a mobile storage unit or an upright index stand and a back—up telephone enquiry service. The telephone service is called 'Extension 99' and provides extra assistance with finding exactly what you are looking for.

One of its latest concepts has been personalised fiche. The benefits of this are that the vendor is able to distribute information to its own clients and update it as often as required. Separate fiche can be set up for each agency or product and marketed accordingly. With personalised fiche, the vendor is able to include extra information when deemed necessary.

The claimed advantages of fiche are many. Eliminating the cost of hard copy and postage is one. The ability to inject more information and detail, but at the same time dispose of bulk and awkwardness in handling, is another.

More details from Robin Kewley ☎ (02) 981-5666.

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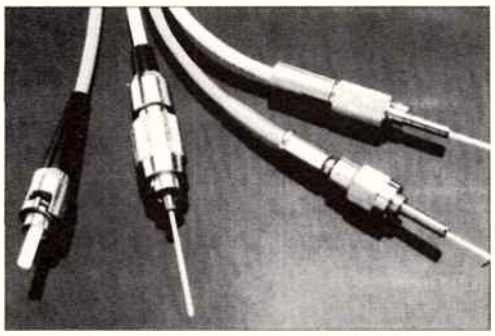

ELECTRONICS TODAY

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7	32	57	82	107	132	157	182	207	232	257	282	307	332	
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12	37	62	87	112	137	162	187	212	237	262	287	312	337	
13	38	63	88	113	136	163	188	213	238	263	288	313	338	
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16	41	66	91	116	141	166	191	216	241	266	291	316	341	
17	42	67	92	117	142	167	192	217	242	267	292	317	342	
18	43	68	93	118	143	168	193	218	243	268	293	318	343	
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20	45	70	95	120	145	170	195	220	245	270	295	320	345	
21	46	71	96	121	146	171	196	221	246	171	296	321	346	
22	47	72	97	122	147	172	197	222	247	172	297	322	347	
23	48	73	98	123	148	173	198	223	248	273	298	323	348	
24	49	74	99	124	149	174	199	224	249	274	299	324	348	
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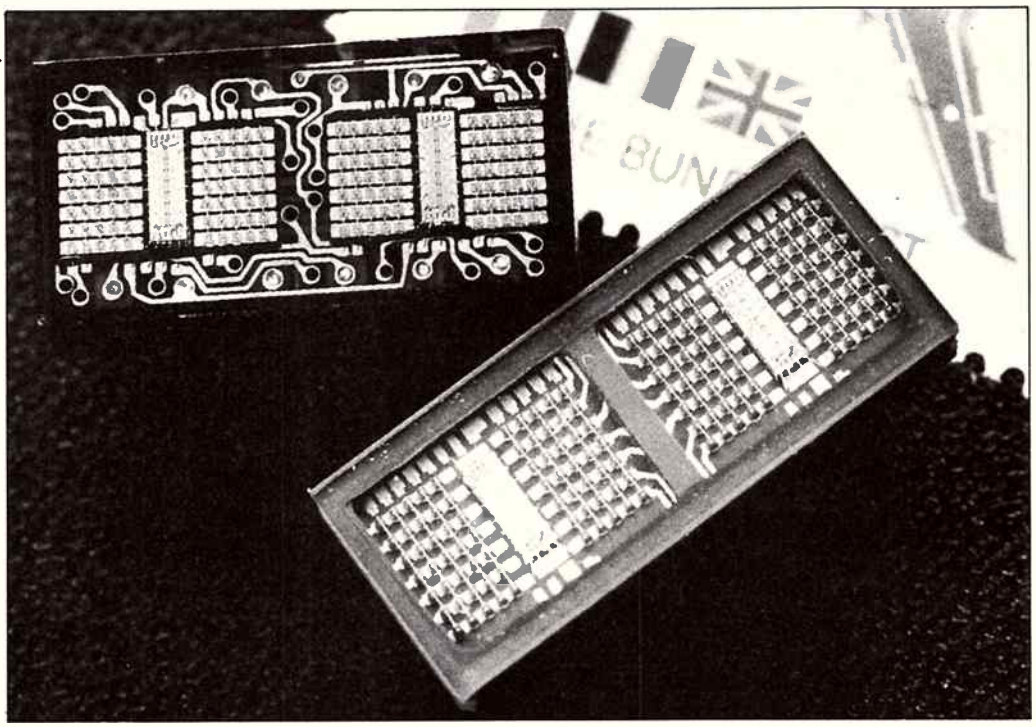
Shifty display ▸



Siemens is marketing LED displays, equipped with a shift register, with which the user can display individual or device-oriented characters and symbols. In contrast to intelligent displays with integrated memory chips, these "semi-intelligent" displays are not restricted to a preprogrammed character set. In addition, the "Samsan" displays operate with LED drivers in CMOS technology which draw less current and develop less heat than conventional displays with bipolar LED drivers. The four-character Samsan series offers character heights of 3.7 and 4.9 mm; the LED chips for each position are configured in a 5 x 7 dot matrix. ☎ (03) 420 7314

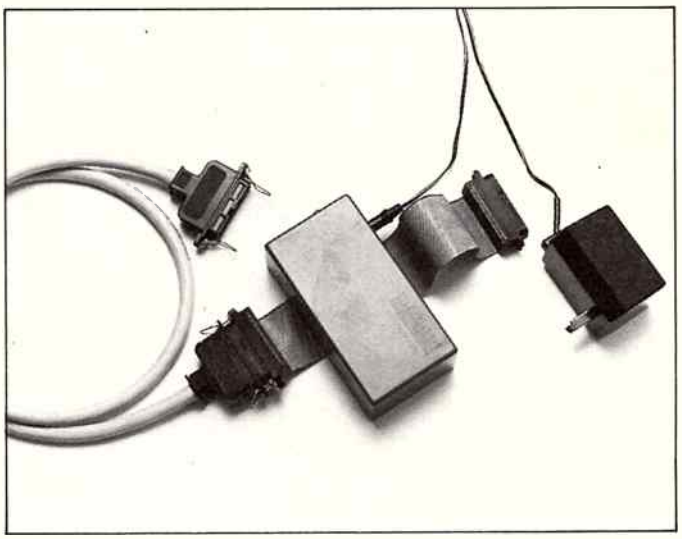
READER INFO No. 279

Dual delight ▼

The ICOM IC-3210A dual band VHF-UHF mobile is a new breed of full duplex transceiver which, among a host of features, allows transmission on one band and simultaneous reception on another band.

With a frequency range covering (Tx) 144-148 MHz and 430-440 MHz, (Rx) 138-174 MHz and 430-440 MHz, and two sets of 20 memory channels, one for each band, storing frequency, offset and tone data, the IC-3210A is very much two transceivers for the price of one. More info ☎ (03) 529 7582.

READER INFO No. 280



Print while you work ▲

Hypertec's new Hyperbuffer is a hardware spooler that allows PC operators to continue using their PC while it is doing print-outs.

It requires no slot but simply connects between computers and printers that use a parallel interface. There is no special setup, switches or software and it measures only 130 mm by 65 mm by 40 mm and it can sit on the desk beside the PC or, with the metre long cable provided, lie on the floor under the desk.

With 256K of memory Hyperbuffer can carry up to 32 pages of 60 lines (assuming 132 characters to a line). More details ☎ (02) 819 7222

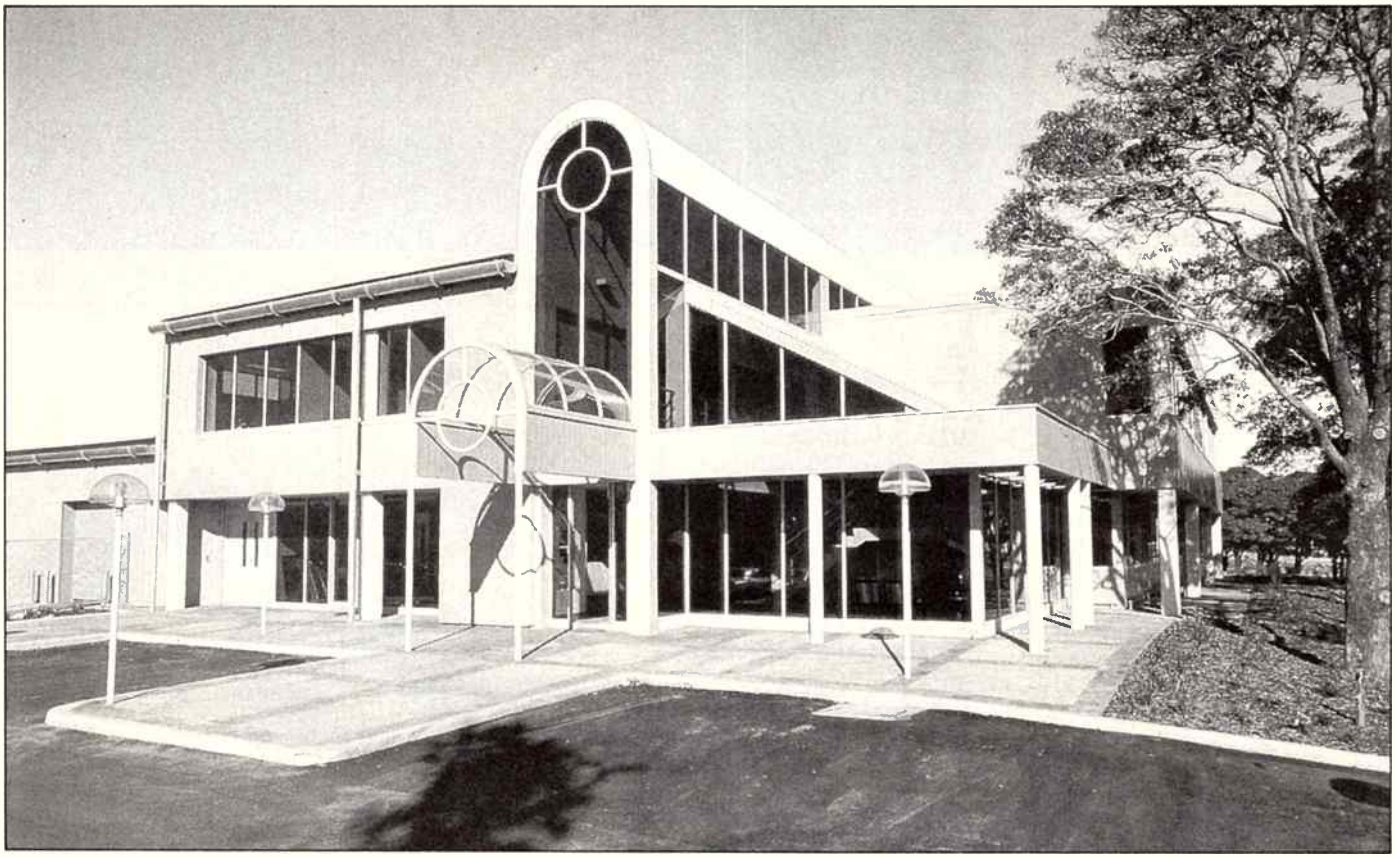
READER INFO No. 281

TECHNOLOGY

SEMICONDUCTOR WATCH

Big ticket technology for AWA micros

ETI's Terry Kee surveys the new AWA Microelectronics centre in Sydney's suburban Homebush Bay and reports on the latest in the semiconductor field . . .



The new Homebush Bay centre

Commissioning is well under way at AWA Microelectronics' new $65 million Homebush Bay facility.

Advanced equipment worth some $30 million has already been installed. When fully commissioned the plant will be the only one in Australia capable of offering a complete one-stop design and manufacturing service for state-of-the-art ASICs (Application Specific Integrated Circuits). The Australian market for these high performance and cost effective chips is growing at about 40% annually.

One of the key features of the Homebush Bay facility is its extremely efficient clean room in which key manufacturing processes take place in conditions far cleaner than the most sterile operating theatre. Tests show that the AWA clean room permits only one particle of 0.1 micron size (about the size of a virus) per cubic foot of air. This is better than the plant's specification and puts the clean room high on the list of the most efficient in the world.

Among other equipment already in place are:

- a $4 million Cambridge Instruments electron beam machine for mask fabrication, capable of writing details of 0.1 micron directly onto wafers
- a $2 million Trillium Validmaster high-speed IC tester
- a Varian 3280 metal sputtering machine for wafer

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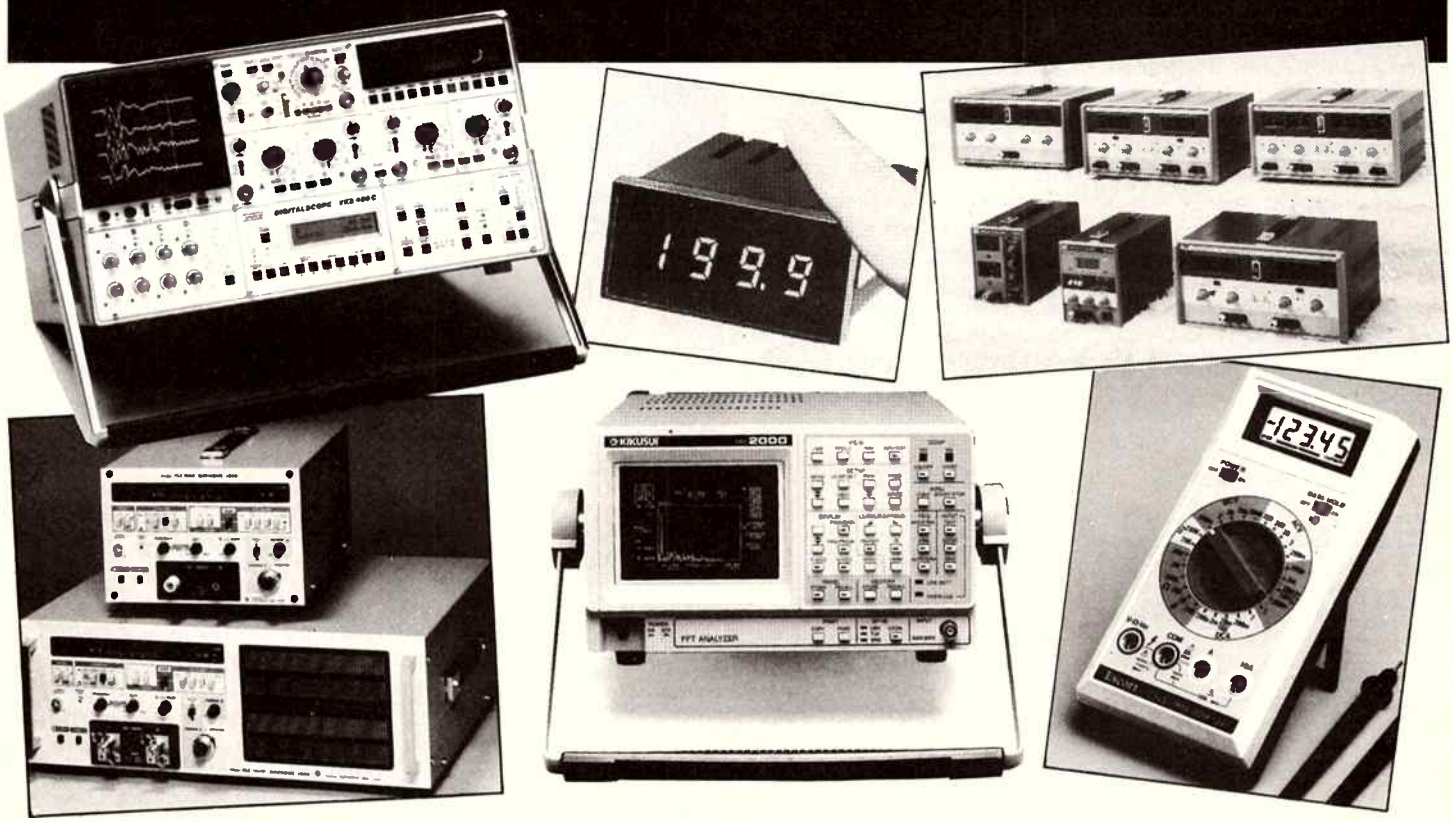

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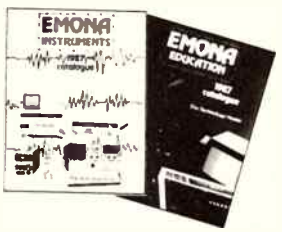

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READER INFO No. 46

metallisation
- three LAM Research plasma etchers, one each for etching metal, oxide and polysilicon
- an ASM PAS 2500/10 wafer-stepper, capable of printing minimum features down to 0.8 microns.

AWA MicroElectronics regards commissioning of the Homebush Bay plant as an important step in its 'Silicon Initiative'. The facillity will also play a key role in AWA Microelectronics' recently launched network of ASIC Technology Centres.

Specialised

"Our strategy is to target specialised market areas such as communications, defence, information technology and medical electronics — the same areas which offer the best opportunities for local equipment makers," says AWA Microelectronics' general manager Bob McCluskey, "Homebush will manufacture designs for ASICs developed at the ASIC Technology Centres around Australia."

AWA's massive investment in Homebush Bay represents the biggest single outlay by the streamlined electronics leader since the company's restructuring earlier this year. The first commercial silicon will come off the production line before the end of this year.

"Once in production, Homebush will give the Australian electronics industry the infrastructure necessary to develop a competitive edge it has never enjoyed before. It will save the country millions which it now spends on importing ASICs," says McCluskey.

READER INFO No. 282

DC-18 GHz GaAs FET SPDT Switch

Benmar Intl has announced the ASM018-01 GaAs SPDT monolithic FET switch designed with E-beam written gate FETs. Depending upon the system design requirements, the switch offers reflective and non-reflective options.

This new small size (1.2 x 2.4 mm), Alpha Semiconductor Division product has features such as broad bandwidth, fast switching (less than 2ns Typ.), high isolation (40 dB Typ.), and low insertion loss (2.0 dB Typ.). The On/Off bias requirements are 0 and −5 volts, with the current typically less than 100 mA at −5 volts. More details ☎ Benmar (02) 233-7566.

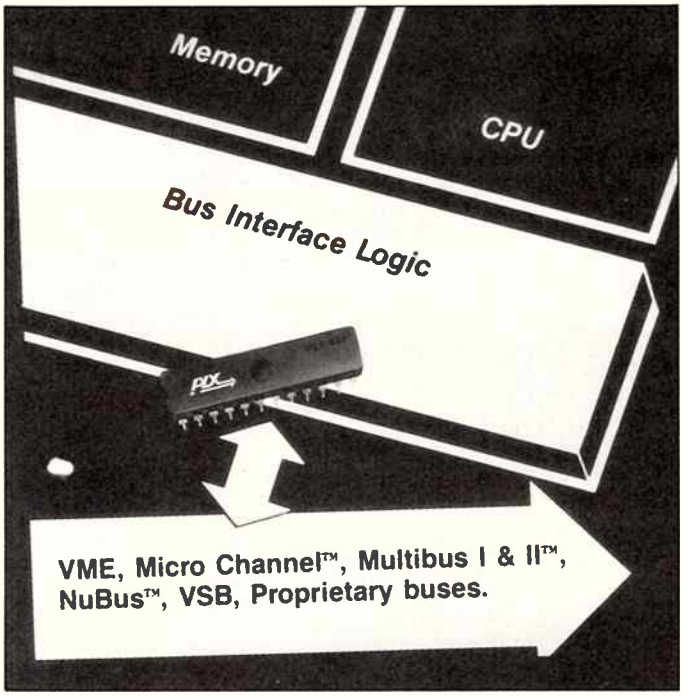
READER INFO No. 283

CMOS for mobile 2-way radio

Siemens has begun mass production of the TBB 200 PLL chip for processor-controlled frequency synthesis. The CMOS circuit is intended for the RF section of two-way radios operating in the mobile frequency ranges, upwards of 900 MHz. The main area of application will be car telephones (C network) and cordless telephones. The maximum input frequency is 70 MHz and typical current consumption is 2 mA. The SAB 80C51 single-chip processor is ideally suited to joint operation with the TBB 200 PLL chip, because both circuits have I^2C interfaces. An SMD version will be marketed as the TBB 200 G. A complement to the TBB 200 is the TBB 202 bipolar circuit; this is a divider chip operating up to 1 GHz with a division rate of 128/129 and typical current consumption of 7 mA. Samples are available.

Further information ☎ Siemens (03) 420-7314.

READER INFO No. 284



EPLD improved ▲

PLX Technology, has announced an erasable programmable logic device (EPLD) having four 64 mA and four 48 mA drive outputs, the PLX 464. This is an improvement over the existing PLX 448 device, which has four 48 mA and four 24mA drivers. According to PLX this is due to a recent design and process improvement.

PLX's new CMOS EPLD is the first to offer direct drive capability with the 60 to 65 mA control signals of VMEbus, NuBus, Multibus II and other high performance busses.

The PLX 464 can also drive eight bits of data to 48 mA drive levels. Designers can program the chip to be an eight bit wide "intelligent transceiver" for 48 mA drive buses including VME and Multibus II.

Designed for high drive current logic applications, this programmable device allows customised implementations of either standard or proprietary bus interface logic. The PLX 464 meets VMEbus, Micro Channel, NuBus, Multibus I, Multibus and other standard and proprietary bus electrical requirements.

In addition to high current drivers, the PLX 464 includes functions which eliminate the need for transceivers, Schmitt triggers and other discrete ICs used in bus interface circuits. This integration reduces the board space required to implement bus interface logic by a factor of 20 to one over discrete logic.

The four 64 mA "Quad-state" drivers are individually programmable to four states: open collector, totem pole high, totem pole low or high impedance, allowing the device to drive open collector signals which are common in bus logic. The 48 mA drivers are three state and all I/Os have two input paths making the device bi-directional. Two separate clock inputs allow the PLX 448 to monitor both the CPU and system bus clock at the same time and a 200 mV input hysteresis filters out bus noise allowing the device to monitor the bus directly.

The PLX 464 is housed in a 24 pin, 300 mm wide windowed DIP. More information ☎ Energy Control (07) 376-3286. READER INFO No. 285

THE QUAD MODEM WITH THE LOT NOW HAS A LOT MORE

You can now buy the newest version of Australia's most popular quad modem – the DPX-224-'10'.

With its impressive array of practical features, the DPX-224 gives you more error protection, more control, more security, more capability, more versatility. It's even easier to operate.

Built in Australia by Dataplex, this professional unit is a full duplex, high performance, medium speed modem that complies with both CCITT and Bell standards from 75bps to 2400bps covering all popular synchronous and asynchronous applications.

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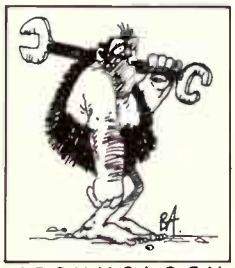
READER INFO No. 47

SINE ON THE LINE

High speed modem techniques

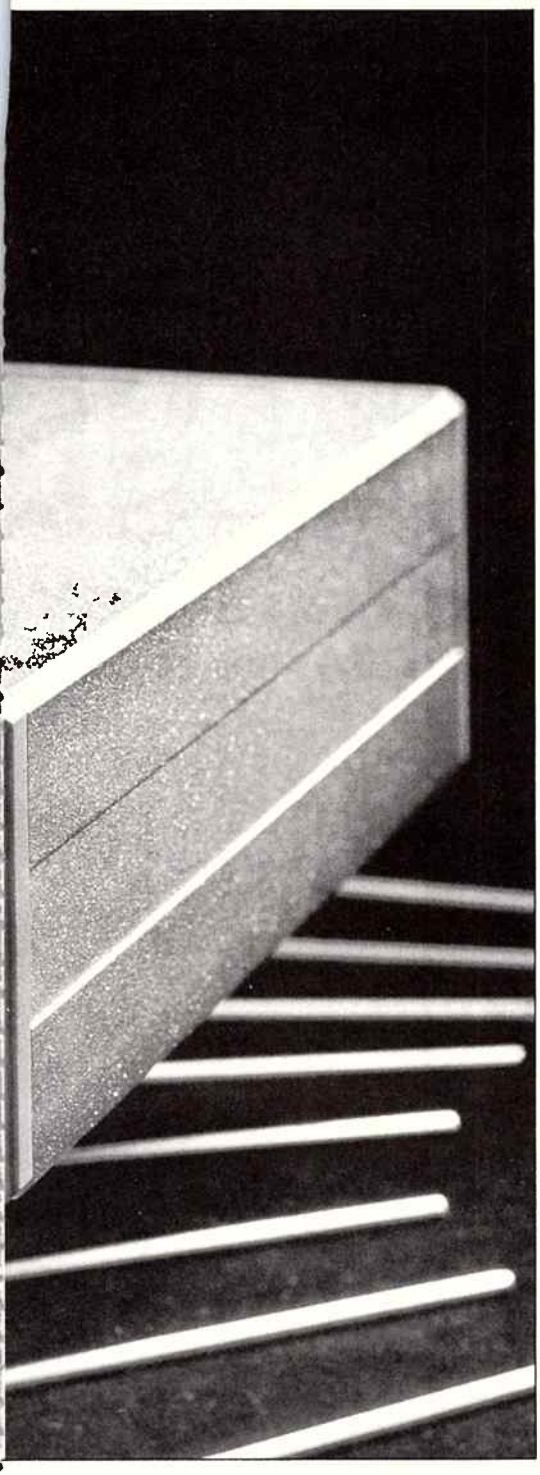
Modems are getting faster and faster. Bill Chapman looks at how they do it.



TECHNOLOGY

Modems are changing rapidly. Not so long ago, one bought a 300 baud modem for a four figure price and was suitably grateful if it worked properly at all. Today, just a couple of years down the track, few manufacturers sell 300 baud modems. 1200 baud is the minimum performance one expects.

Meanwhile 2400 baud is becoming common, even at domestic prices, and people are starting to think of 4800 baud as a reasonable figure. And everyone knows that 9600, still the preserve of the rich and famous, is just around the corner.



There are problems in building high speed modems however. The simple methods used at 300, or even 1200, baud no longer suffice. To achieve high speed, some interesting new techniques are being used.

Speed

The basic principle of modem operation is not difficult to undertand. It transmits sine waves somewhere in the audio pass band of the telephone circuit. There are two frequencies, one associated with a logic 1 and the other with a logic 0, and a transmission simply consists of a sine wave, first at one frequency, then the other, as a string of ones and zeros are sent from the computer.

Naturally enough, this system depends, for its reliable operation, on the quality of the line. The two frequencies must be within the telephone pass band, nominally, 300 Hz to 3300 Hz, but often considerably less. Thus the possible range of frequencies is severely limited.

The rate at which these frequencies can be changed is the rate at which information can be sent down the line. It's called the baud rate. The exact frequencies and baud rate depend on the relevant standard and whether the modem is in transmit or receive mode. It's important to notice that the baud rate is the rate at which the modem changes state. It's not necessarily the rate at which it's sending information. This is measured in Bits Per Second or bps.

For instance, one possible method of decoupling bps and baud rate might be to increase the number of frequencies. If there were four possible frquencies, we could send dibits, so f1 might be 0,0, f2 might be 0,1, f3 1,0 and f4 1,1. Now, even with a 1200 baud rate, we could achieve 2400 bps. If we went to eight frequencies, we could have tribits and a 3600 bps modem.

This might give the impression that we can increase speed almost indefinitely, while keeping within the bandwidth of the line. Increases are not without cost, however. Discriminating four, or eight frequencies is a far more complex job than discriminating between two. It also makes the modem very vulnerable to the response of the telephone line.

However, FSK isn't the only form of modulation it's possible to consider. Phase modulation is also possible. A modem able to discriminate four phases will yield dibits, eight will give tribits and so on. In phase modulation only a single frequency is neccessary, and that can be located anywhere inside the pass band of the telephone system.

This method is called Differential Phase Shift Keying, (DPSK).

I turns out, however, that phase modulation is a relatively simple process to implement.

How does it work? Two sinusoids (A and B) are added together to form a resultant (R). Provided that A and B are of identical frequency, R will also be a perfect sine wave of the same frequency. However, the phase shift of R will depend on the phase difference of A and B. If A is seperated from B by 90 degrees, R will be at 45 degrees. Moreover, if we multiply a sine wave by minus one, which is easy to do in a digital environment, we can flip the phase of either A or B through 180 degrees. This in turn will change the position of R by 90 degrees. Thus with some fairly basic circuitry, it's possible to generate a four phase DPSK modem.

But this is not all. It's also possible, in a method known as Quadrature and Amplitude Modulation (QAM), to make the carrier vary in amplitude. Say we allow the sinusoid to have two amplitude values. This means that at any time, we can characterise the signal as having one of four frequencies as well as one of two amplitudes, thus generating tribits, or say, 3600 bps on a 1200 baud signal.

Standards

Of course, there would be no point in making a modem, unless there was another modem for it to talk to, and thus the setting of standards is a matter of the highest importance.

There is a smorgasbord of standards for manufacturers now available that allow these techniques. For instance, V27 offers an eight division phase shift of a carrier situated at 1800 Hz. The baud rate is 1600, thus achieving 4800 bps.

Somewhat newer is V22bis, a 2400 bps standard that uses 16 phase QAM running at only 600 baud. It's a fully duplexed system in which the originating modem transmits at 1200 Hz and the answering modem at 2400 Hz.

V29 is the oldest of the 9600 baud standards, and is a development of V22bis. It uses the same 16 phase QAM, but on a single frequency of 1700 Hz, right in the middle of the voice band. The baud rate is increased to 2400, so yielding 9600 bps, but only in single duplex operation.

The newest standard is V32. It's quite similar to V29, but uses 1800 Hz. It also offers a 32 phase QAM system as an option. This is quinbit encoded (5 bits). 32 phases will normally only yield four bits, but it's possible to derive a fifth with a bit of extra cunning which can be used as a check code. This im-

proves the signal-to-noise ratio of the device.

V32 is also a full duplex system. Although both sender and receiver use the same frequency, the two signals are seperated by echo cancellation techniques. Echo cancellation makes use of Digital Signal Processor (DSP) chips. The DSP chip is fed a copy of the signal on the line, containing both received and transmitted data, plus an inverted copy of the transmitted data. The two copies of the transmitted data cancel each other out, and only the received data is left.

Modifications

Echo cancelling, it hardly needs to be said, is rather more difficult to do than to describe. The DSPs operate at 25 to 50 million instructions per second, and they work hard. Some manufacturers have shied away from the design work needed to achieve it, and instead have opted to provide a form of modified full duplex V29.

One way of doing this is with the so-called ping pong modem. In this approach, the two modems take turns in sending data down the line. When one is transmitting, the other is receiving. Data sent to the modem from its host is buffered in the modem, so that the ping pong process is transparent to the end users.

Ping pong modems are clearly inefficient, so a modification to the ping pong idea is now quite fashionable. This is called statistical duplexing, in which the time either modem spends in transmit or receive depends on the amount of data in its buffer. If one modem is downloading a file, and the other simply wants to receive it, it makes sense to allow the sender access to the line. A low speed 300 baud reverse channel is included outside the V29 pass band for low priority information comming the other way.

Another approach to high speed modems is not to change the modem, but rather to change the way the data is sent. This is data compression, and consists of developing clever ways to compress (say) ten bits into four, then take the four and explode them back to ten bits at the other side.

Such techniques permit relatively trivial low speed modem designs to look like sophisticated high speed jobs. How well it works depends on the compression algorithm, but if this can be made to work there are important side benefits, not least being that slower modems are more line tolerant than fast ones, with all that implies in terms of reliability and signal to noise ratio.

The ultimate

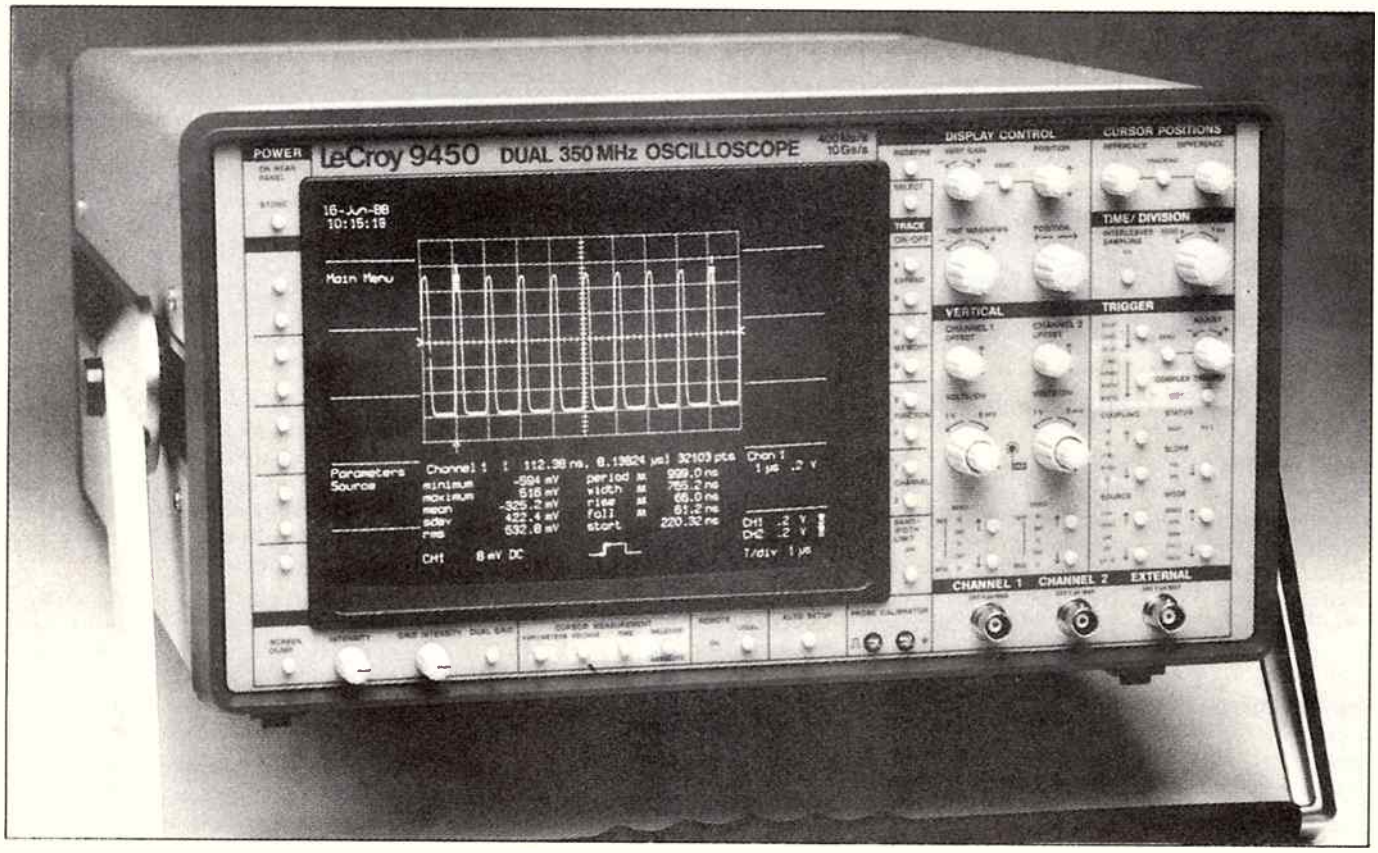
The fastest modems now under consideration are not developments of V32, but rather go back to some of the earliest ideas on modems. By multiplying the number of carriers, perhaps into the hundreds, it is possible to achieve extremely high speeds while using extremely low baud rates.

This is the basic idea behind spread spectrum technology. It's not a new technique, being used extensively by the military, but it is now possible to see price coming down to the point where it will be available to domestic consumers.

In a modem application, the carriers are spread right across the telephone bandwidth, and each is modulated quite slowly. Serial data from the host is spurted into a buffer, where it is reassembled in parallel and then each bit output onto a seperate carrier.

It's possible to make such modems extremely line tolerant. During the set-up period, two modems can investigate carrier strength right across the telephone passband, effectively mapping it and eliminating those carriers with insufficient amplitude. The speed of transmission then becomes purely a function of the line. The more carriers the wider the digital words and the faster the transmission. eti

Bill Chapman is an engineer and occasional ETI columnist.



HIGH SPEED, LONG MEMORY

LeCroy's 9450 digital oscilloscope

Is what you get what you see, or did it all occur in the processing? Jon Fairall looks at the new LeCroy 9450.

The LeCroy instrument company has just put out a new top-of-the-line digital oscilloscope, the model 9450. Fred Blake of ETP Oxford, who will be distributing the machine for LeCroy, invited ETI to a seminar on the ins and outs of understanding a digital oscilloscope.

The most interesting part of the discussion concerned the emphasis on long memory in digital storage oscilloscopes. It turns out the memory size has important implications for the way a Digital Storage Oscilloscope (DSO) performs.

The front panel only tells part of the story. The 9450 is a 350 MHz oscilloscope. Fast, you might say, and you would be right, especially in a digital product. However it turns out that bondwidth is a pretty misleading way to categorise a DSO.

This may seem strange if you are used to categorising analogue CROs. In the analogue world, bandwidth is probably the single most important criterion in determining whether the instrument will be able to see the waveform. In the digital world, it is but one of the criteria,

and not a particularly important one at that.

To see why, consider the theory. A DSO works by sampling the incoming waveform in an Analogue to Digital Converter (ADC) which turns the waveform into a digital word. This is dumped into memory. The contents of the memory are then displayed on the screen, after suitable processing.

The screen of a DSO is thus a succession of points, each corresponding to the value of the waveform to the instant the sample was taken. If you look at the display of a DSO, however, you will see a smooth waveform not unlike that in a conventional CRO. This is because an algorithm in the processor that controls the display is used to join up the dots to give a smooth trace.

Straightforward, except . . .

The process sounds straightforward enough, except for one thing. What happens between the dots? The central problem for DSO builders is to ensure that nothing unusual happens, so that the final trace on the screen is a true reflection of the input. This turns out to be very difficult, especially if you want to go fast.

Three interrelated factors in the specification of the machine interplay to determine how big the gap is between the dots. First is the speed of the timebase. All things being equal, the faster the timebase moves across the screen, the bigger the gap between dots.

The second thing is the sample rate, the rate at which the waveform can be sampled. Clearly, the more often it can be done, the more dots will appear in a given distance on the screen.

The third thing is the memory length. The bigger the memory in the DSO, the more samples can be held, the more dots there will be and so the closer together the dots will be on the screen.

It would be nice to be able to optimise all these numbers to make the DSO process and display information so fast that it outruns the ability of the leads to deliver the signal. Predictably, however, all sorts of other factors come into the picture.

The position of the timebase, for instance, can't be set arbitrarily. It is going to depend on the signal under observation. There is not much room to change it.

We are also constrained in the sampling rate. The first problem is fundamental to the design of the system. Given a particular number of points, the sampling rate is fixed by the timebase. That is, the timebase will always be set up such that the points are evenly distributed across the display, so the duration between them is determined by the timebase.

Hardware constraints

Of course, this is true only up to a certain limit. At a particular sampling rate, hardware constraints come into play. The ADC has a limit to its upper speed, and traditionally it is this that has limited the performance of DSOs. In the case of the 9450, the ADC can yield 400 megasamples per second. It's a phenomenal rate, but it leads to an analogue equivalent bandwidth of only 200 MHz; impressive, but hardly fast enough to set the world alight.

The third constraint is memory length. There are a number of reasons why memory can't be expanded without limit. The first, and probably least important, is cost. DSOs cost big money; the Lecroy sells for around $30k, so a few hundred for extra memory is fairly insignificant.

More significant is that the more memory one needs, the more memory one needs to look after. It takes time to fill it up, time to empty it and display it, and so on and so forth. This may seem trivial, but from a user's point of view it is absolutely vital. One of the most devaestating criticisms of the early DSOs by old analogue men was that they had a slow response time. Consequence: every reading entailed placing the probe on the signal source, waiting for perhaps a second or so while untold calculations were made, and then making a reading.

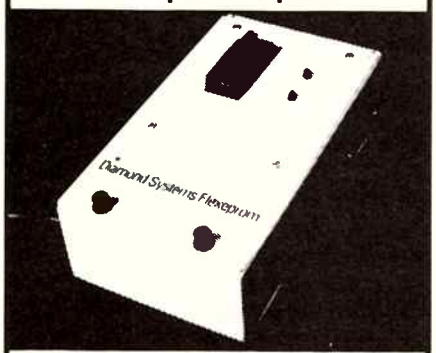
However, there are ways of fudging it so that memory can be expanded considerably. The LeCroy, which has 50 K on board, has four processors, each with its own dedicated function. This makes it possible to seperate out tasks like memory management, front panel reading and display control. Of course this poses its own set of problems in making sure that one processor knows what the other processor is doing, but the problems are obviously not insuperable when there are only four processors. As the number expands, so does the complexity. Thus there is a finite limit to the extent to which the process can be taken.

Conclusions

So, what does this demonstrate?

First and foremost, perhaps, that no single criteria can be used to understand the relative merits of a DSO. There is no single criteria one can apply to a digital machine that replaces bandwidth in analogue CROs.

What about sample rate, which is often used as a synonym for bandwidth? It is true, of course, that all other things being equal, the faster the sampling rate the better, but if things are not equal, it's a very misleading measure. Remember that the quoted sample



rate will be the maximum speed of the ADC. However, the real sample rate on any particular setting will depend on the timebase setting and the memory length. Thus, if the timebase is set to run slowly, there will be more than enough points to fill up the screen, and the ADC will be programmed to run slower than its maximum speed. At some setting of the timebase, the ADC will be running at its maximum.

Thereafter, there will be insufficient room on the screen to display all the available data points, and they will start to fan out, becoming visible as jaggies on the screen. The value of that setting, of course, depends on the number of points, i.e: the memory length.

To illustrate the point, it's worthwhile indulging in some arithmetic. Assume a DSO with a memory of 1 K, a sampling rate of 400 Ms/s and the time base set to 50 uS per division. What's the real sampling rate? It's given by the number of samples to be taken (the memory size) divided by the length of the timebase. Since the screen has 10 divisions:

Sample rate=1000/(10 divisions x 50 uS)
=2 Ms/s

Whatever is limiting our DSO, it's not the ADC. To see how we can make the ADC work a bit harder, let's increase memory length to 50 K, as in the 9450:

SR = 50 K/(10 x 50 uS)
= 100 Ms/s

This illustrates the effect of memory length, but notice that the ADC is still not working flat out. How fast can we go? To find out, let's rearrange the equation to solve for a sample rate of 400 Ms/s and a memory of 50 K (i.e: the 9450's specifications.)

Timebase setting = memory length/ (SR x 10 div)
So:
=50 K
400 M x 10
=12.5 u

So, anything faster than the 10 uS setting will result in the unit being limited by its ADC. If we assume two periods per division, this leads to a practical viewing frequency of only 100 kHz.

RIS

This is hardly practical in a high cost CRO, so DSO makers have developed a number of tricks to help them get around such limitations. One is the analogue glitch detector. Typically, a glitch detector block diagram shows a comparator followed by a sample and hold circuit.

In the past, glitch detectors have been suspect because of the finite time they require to reset themselves after every peak. In early DSOs, it was typical to disconnect the glitch detector above certain timebase speeds for this reason.

The 9450 has a circuit called Fastglitch, which substantially reduces this problem by reading on any spikes as narrow as 2.5 nS. What's more, it is linked through to the trigger mechanism such that it is possible to trigger on the glitch, no matter where it may occur.

A second, and more profound method of extending the effective bandwidth of the LeCroy is called random interleaved sampling (RIS). This method assumes that a repetitive waveform is present on the input. Each time the trigger fires, samples are taken by the ADC at its maximum sample rate, and placed in the appropriate memory locations. The exact position of each sample is random, although its position can be measured with great accuracy, down to the picosecond level. The process continues until all the memory locations are filled up. The software tries to ensure that each sample is placed in the centre of the gap between two existing samples, thus ensuring an equal spread of sample points across the waveform.

Using this technique, the effective sampling rate can be pushed up to 10 Gs/s. This mode is used whenever the timebase is set between 1 nS and 5 uS. While impressive, it is worth while noticing that random interleaved sampling does assume that the waveform is repetitive. It would provide misleading results if the waveform was changing slowly in either frequency or amplitude. But that is a small price to pay for marrying all the considerable advantages of a digital storage oscilloscope to the speed of a high bandwidth analogue CRO.

Bandwidth

It's worthwhile and illuminating to compare the numbers that apply to the 9450.

RIS allows an effective sampling rate of 10 Gs/s. The Nyquist limit for this is just one half, i.e: 5 GHz. More realistically, with eight samples per period, we get a practical bandwidth of some 1.25 GHz. However, things are not quite that simple, because the front end has a bandwidth of 350 MHz. Any signals faster than this will reach the ADC distorted by the front end circuitry. Without RIS the sample rate is limited to 400 Ms/s, leading to a practical bandwidth of 50 MHz.

What does it all mean? Just that, as with any machine, the results need to be interpreted with some caution. What you see is sometimes not what you've got. eti

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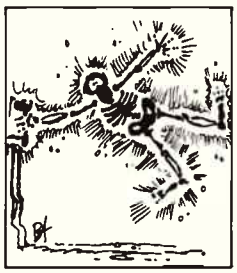


E T I — 1 6 1 8
E L E C T R O N I C S

MODEM Part 2

Last month we covered the smartmodem processor card. This month Nigel Kulkulka tours the modem card.

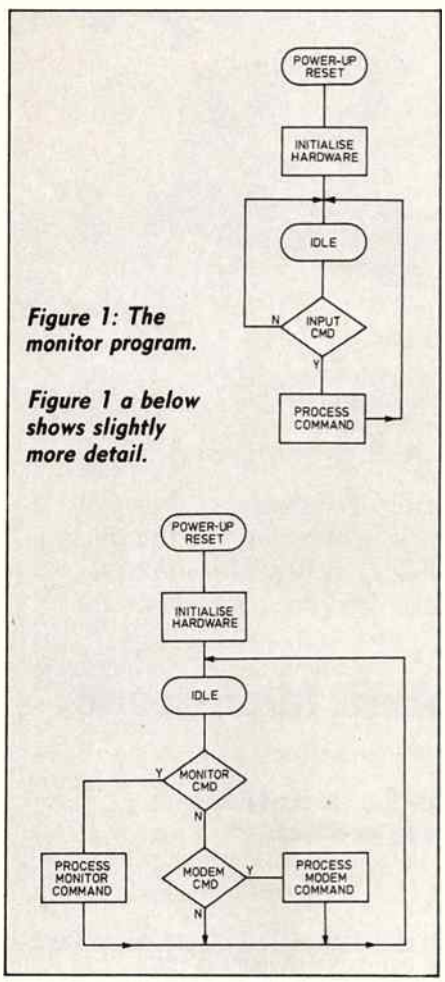


Figure 1: The monitor program.

Figure 1 a below shows slightly more detail.

The ETI 1618 processor card contains all the neccessary components to interface with the telephone line and the modem card. Hence we only require a minimium of components on the modem card to get it up and running.

A quick look at the circuitry will show you that there are two modem chips, the 7910 world modem chip which operates in FSK mode giving us V21 and V23 i.e: 1200/75 and 300/300 respectively, and the Thomson 7515 modem chip which operates in the DPSK mode for V22, i.e: 1200/1200. The rest of the chips comprise latches and multiplexers to set-up (under the control of the microprocessor) the respective conditions on the control lines to the modem chips, and to manipulate their output signals. Signal amplifiers and duplexer circuit arealso contained on the modem card, as these may vary, depending on the type of chipset

being used.

The modem card also contains its own power supply. This is to ensure good grounding between the supply and the modem chips, as they are very susceptible to earth loops due to poor layout. Decoupling capacitors have been placed close to the modem ic supply leads.

Each modem chip has its own crystal. This ensures reliable performance of the modem ics, as most of the internal circuitry of both chips requires a stable and accurate master frequency. The operation of the switch capacitor filters, and frequency synthesis will ensure proper operation of the ics.

Construction

Before you start populating the pcb check it for any mistakes or damage that may have been missed during the manufacture of the board. When you are happy with your inspection begin by placing all the low profile components, such as resistors and diodes making sure that the polarity of the diodes are correct. The modem chips are expensive to replace !

Next, mount the ic sockets for the modem chips followed by the TTL logic ics, then the CMOS ics, being cautious whilst handling the CMOS chips. Now mount the rest of the components on the board and check to make sure that everthing is where it should be and the right way around. Turn the board over so that the components are face down on the bench, and then fit the two 40 pin connectors to the board and you should be ready to roll.

Fit the modem card to the processor card and turn on the power. If all is well take hold of your trusty multi-meter and check the voltages of the chips. Now you should be able to hook up your pc

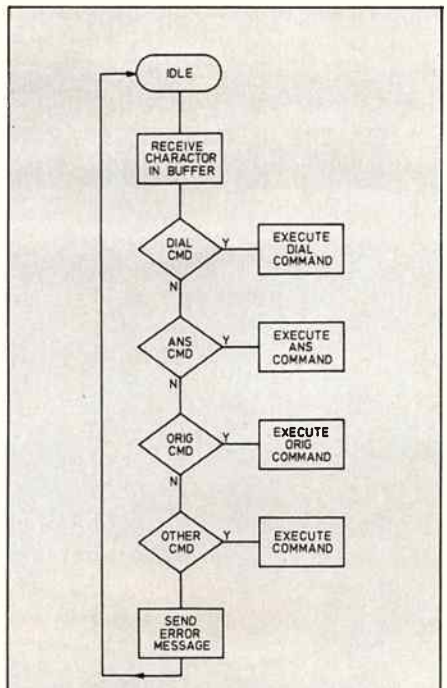


Figure 2: The command routine.

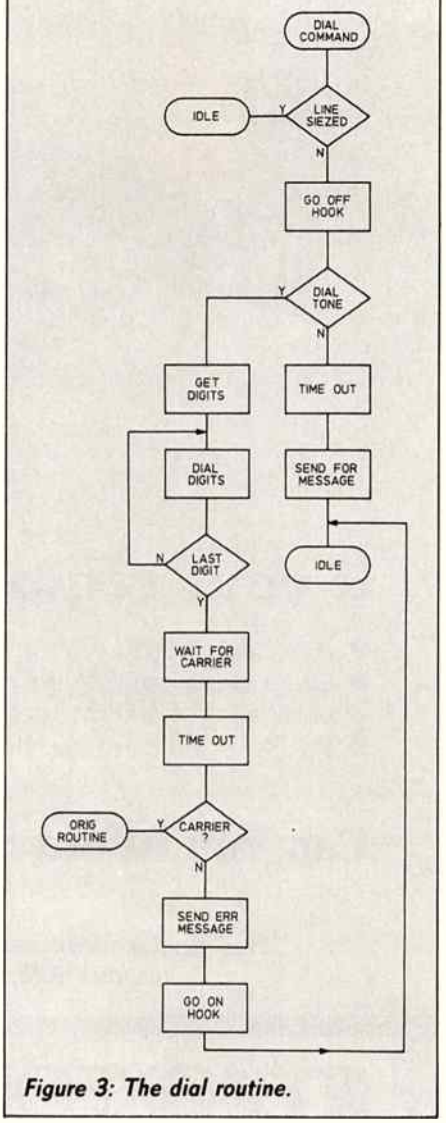
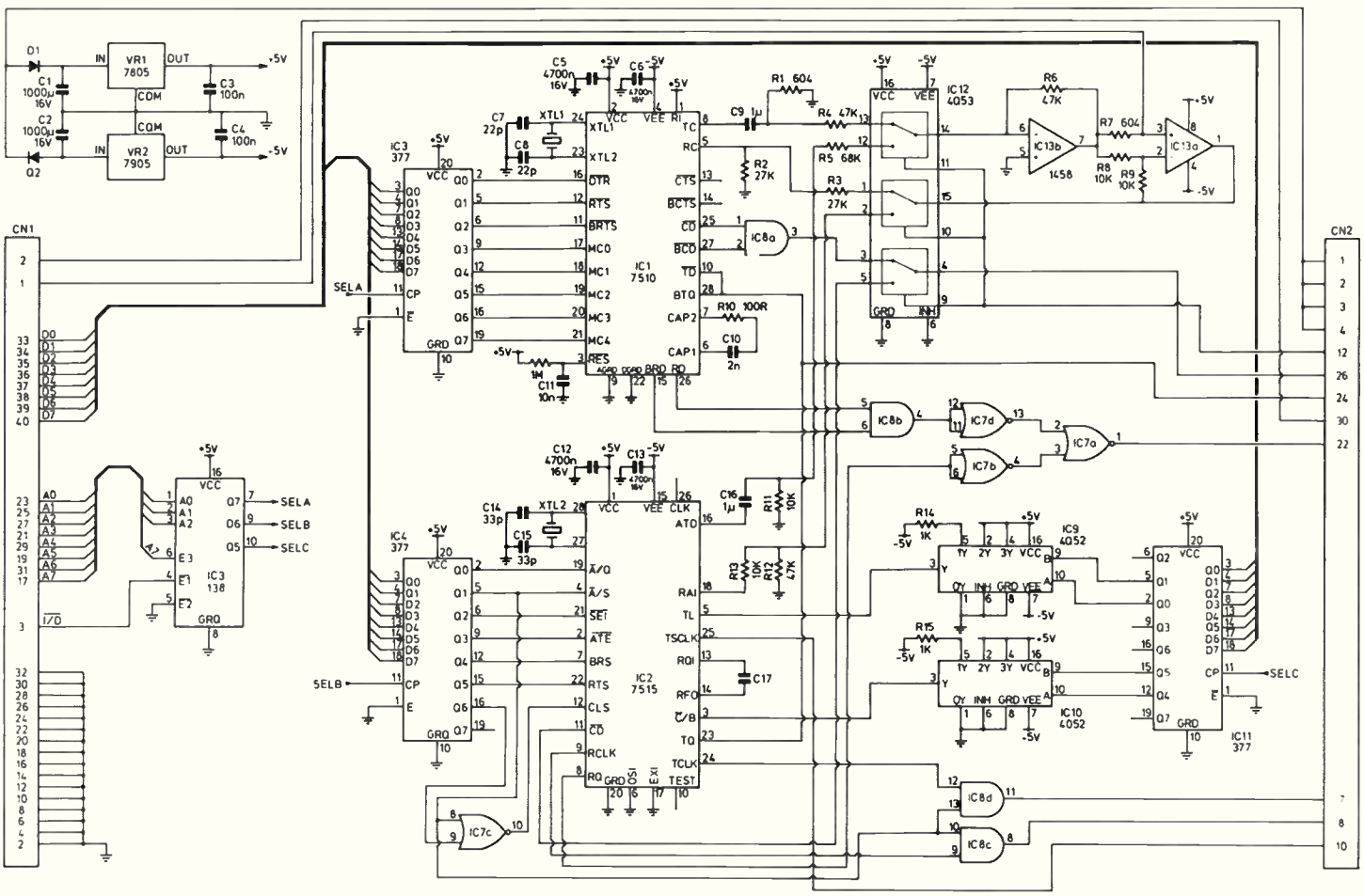


Figure 3: The dial routine.



HOW IT WORKS

The lower eight address lines are brought up onto the card via CN1, where A0,A1,A2,and A7 are decoded by the 74LS138 (IC5). The I/O signal generated by the micro card strobes the address onto the output of IC5 which in turn strobes the data lines into one of the three octal latches formed by IC3, IC4 and IC11. Two latches are required to set the 7515 (IC2) because this chip is very complex as will be seen later.

The 7510 (IC1) has only one latch as it is a relatively easy chip to work with. Thus we shall be able to use all modes provided by the chip, except for one: the auto answer mode. We have tied the ring interrupt pin high, as any low on this input will put the chip into a predetermined sequence of events that may not be compatible with the 7515 (IC2) modem ic. However during auto ans the answer tone can be controlled by the Thomson chip.

The 4053 (IC12) is an analogue switch that controls the direction of the transmitted and received line signal. It is also used to switch between each modem chip during the auto ans sequence.

The 1458 (IC13) is a dual op-amp that makes up the signal buffer and line duplexer. The 7515 is a DSPK and FSK modem ic. It is quite a complex chip and requires more hardware to control its functions than that required for the world modem chip.

The 74LS377 is an octal latch that sets up the logic states of the 7515, however, two analogue multiplexers, 4052 (IC9 and IC10) are required to set the tri-state conditions on some of the inputs to the 7515. The multiplexers are in turn controlled by the conditions placed on the outputs of the third 74LS377 octal latch.

Finally, the two AND gates from IC8 are used to extend the synchronous clock signals that are produced by the 7515 when operated in the synchronous mode. This is handy when the modem is connected to a synchronous device such as a data multiplexer or concentrator.

and VDU to the modem.

Enter the change memory mode of the monitor. With the information supplied with the modem kit, type the hex code into memory at the location specified. Follow the rest of the instructions to quickly test the operation of the modem card.

Once this has been done, turn off the modem and replace the monitor EPROM with the one supplied with the modem card and proceed with the instructions supplied with the kit.

The software

Last month the software was briefly presented as it was only a monitor that allowed you to hook up a VDU, or a pc operating as a dumb terminal. At the very least, this allowed one to check out the processer card and help debug it if required. Figure 1 shows you a brief flow chart of the monitor program.

This month the software is more complex as it contains not only the monitor, but routines to set-up the modem chips for operation on line, dial numbers and automatically answer and disconnect the telephone.

To save on complexity in the software, there are four main routines as shown in figures 2 to 5. These are ent-

ered after initially entering the modified monitor routine as shown in figure 1a.

The command set used is a derivative of the Hayes commands. This was done not only to reduce the number of commands in use but to allow easier implementation of your own commands, such as pass word recognition and ring-back routines.

As was mentioned last month, there is a dip switch located on the underneath of the processer card. This switch is read upon initial start-up and during the command routine. It enables you to make changes on the fly. It can also be used to make hard wired decisions such as answer only in V22 mode or answer phone in originate mode etc.

A communications software package written in C is also available at a moderate cost, it contains many features that are normally only found in more expensive commercial products.

How to buy it

The kit as described this month includes the pcb, all ics and other components, new software EPROM, construction details and software description.

Price: $119.00 ex tax; $129.00 tax paid. Please allow $9.00 per kit for post and packaging.
Datacom Computers Comms package: $49.00 tax paid, plus post and packing of $5.00.
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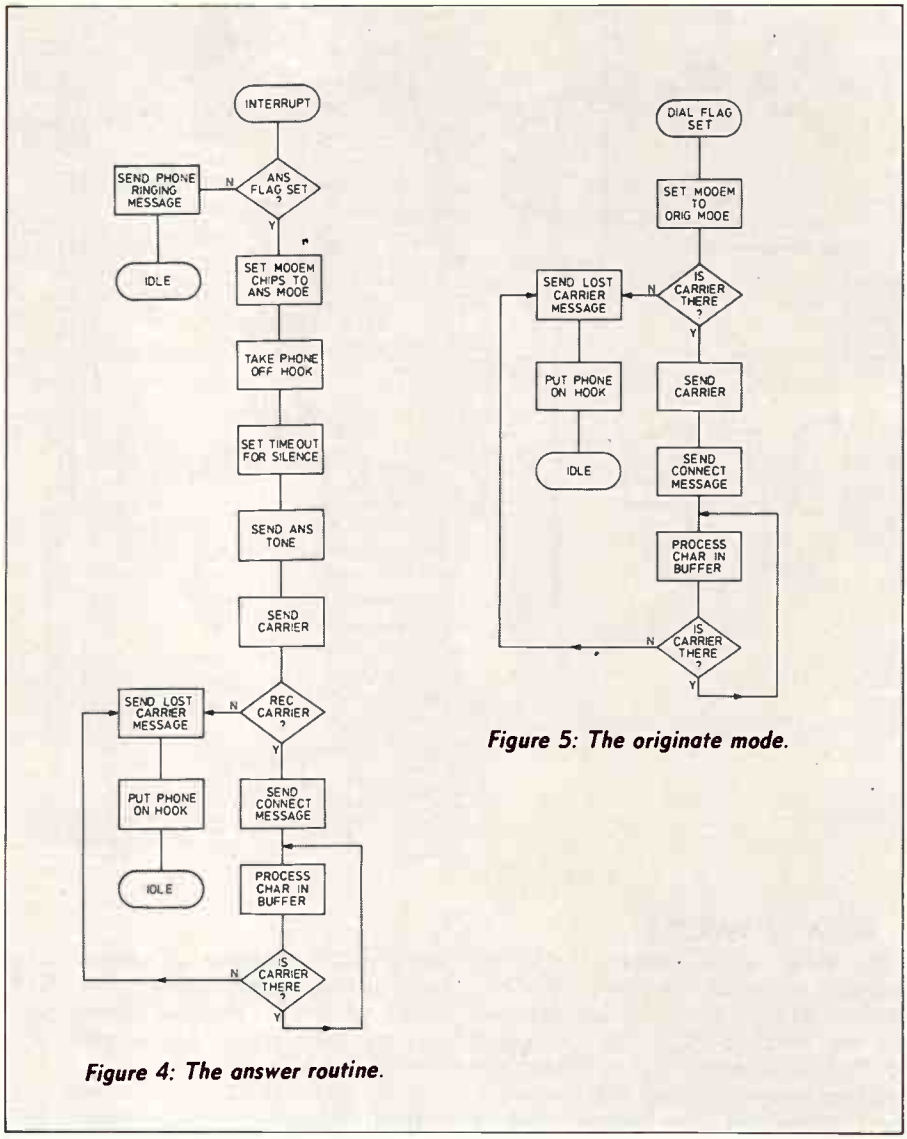
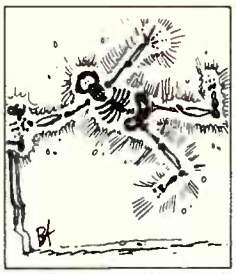


Figure 4: The answer routine.

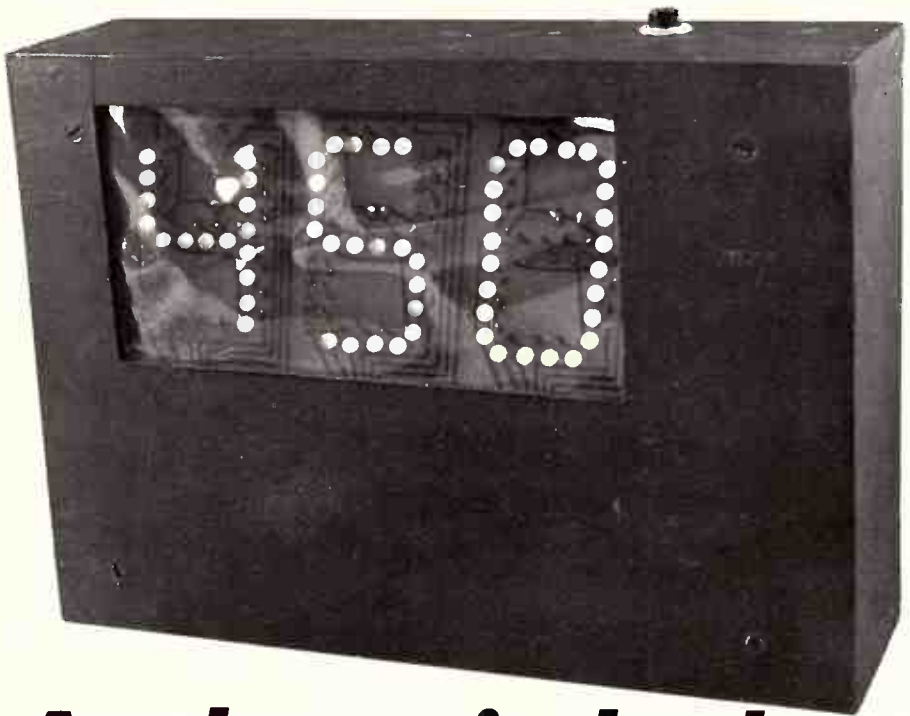
Figure 5: The originate mode.



E T I - 8 1 5
E L E C T R O N I C S

Australian charities abound with fund-raising systems, with the most common being perhaps the good old raffle. ETI's Geoff Phillips tells the tale of a clever guy in the numbers game.

PUTTING LED INTO THE NUMBERS RACKET



An electronic chook raffler to build

Every week the Grand Order of Chook Rafflers held a prize draw. The committee was bored to tears with laboriously tearing off all the ticket stubs every Saturday, folding up each one and placing them all in a hat.

They tried using a cage full of numbered balls, but some got lost during a ping-pong game and anyway the patrons were complaining that the draw wasn't fair.

"How can we at the back of the joint be sure that the ball you've drawn has the number you say?" shouted one of them. The integrity of the committee was in question and drastic measures were required. A special committee meeting was held.

"I think we should have one of them didgy-tell number machines like down at that fancy new pub in town," said the chairman of the committee. "But the club can't afford one of those things," the treasurer quickly added.

"The butcher's son Wayne fiddles with electronical things," said the steward. So Wayne was asked to design and build an electronic random number generator.

What Wayne did

There are never more than 1000 tickets sold at the draw so a 3-digit number generator would be adequate. It had to be simple to operate (for the committee) and the numbers had to be big enough to be seen from the back of the bar. Wayne decided to use a matrix of conventional LEDs for the display as the seven segment displays available from his hobby supplier were too small.

The next problem was how to generate random numbers. Wayne had once visited the young people's Christmas disco party in one of the town's clubs. He wasn't too impressive at dancing, and the girls seemed a little alarmed by the blood on his butcher's apron, but what did catch his attention were the one-arm bandits. He reasoned that each time the lever was pulled the time period before each drum stopped must vary slightly, otherwise a regular series of patterns would occur. The speed of the drums at each play probably varied too.

Wayne knew how to design an electronic counter which would cycle the digits 0 to 9 in a similar fashion to the wheels on a poker machine, but the speed of cycling would be constant. He also knew how to generate a time delay electronically so as to simulate the time the drums spun, but again this would be constant each time it was triggered. He knew that if the members could spot a repetitive pattern of numbers generated by the machine he designed, there would be trouble . . . big trouble!

If the numbers were cycling all the time however, and were stopped when a button was pressed, then the numbers should be random — the button pressing would not be linked to the electronic counter in any way.

But Wayne realised people would suspect foul play if the numbers were stopped by a committee man. The machine had to appear to operate like the one-armed bandit with the numbers apparently stopping of their own free will.

Freeze

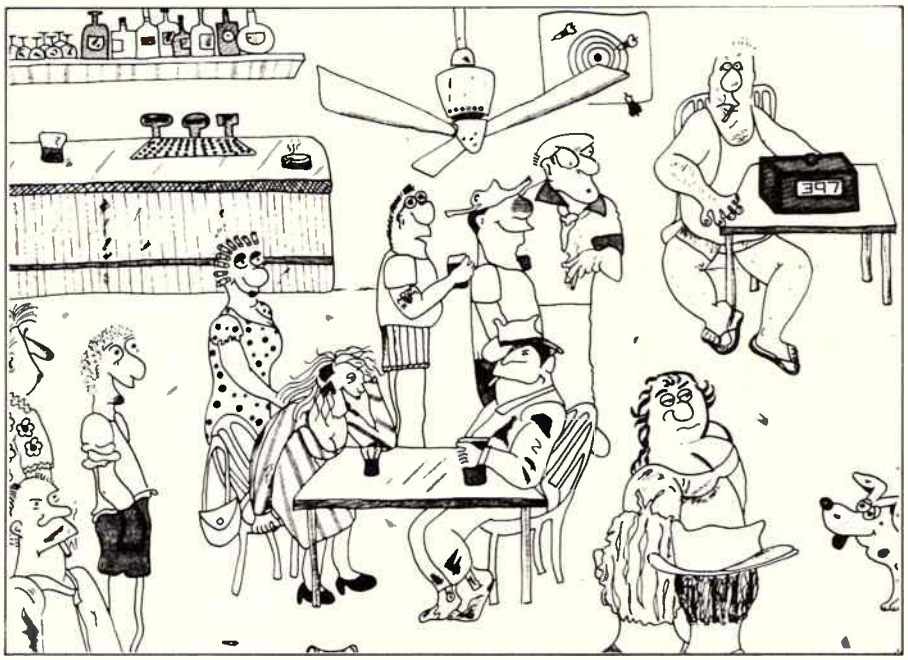
For a few days this had Wayne

stumped. Then, while he was trimming a particularly inspiring piece of rump, he had a brainwave. He could make the counters cycle all the time but only connect them to the LED display when the button was pressed. Using three separate time delay circuits would make the three digits freeze one after the other just like a one armed bandit. Although the cycling time and the freeze delays would be constant, the final number displayed would be completely random because the button would be pressed at random with respect to the constantly cycling counters.

He would need three separate square wave oscillators to clock the three counters. He used 555 timers for the oscillators and the monostable or time delay circuits, as he had dozens of them in his spares drawer. He used the CMOS 4510 BCD counters which were quite cheap. The CMOS BCD to 7-segment decoder was ideal for driving the LED display because it had built-in latches which could store the winning number.

Wayne was quite good at laying out PCB artwork and with three identical channels, the amount of brain power required was reduced still further. Once the PCB was etched and drilled he set about construction.

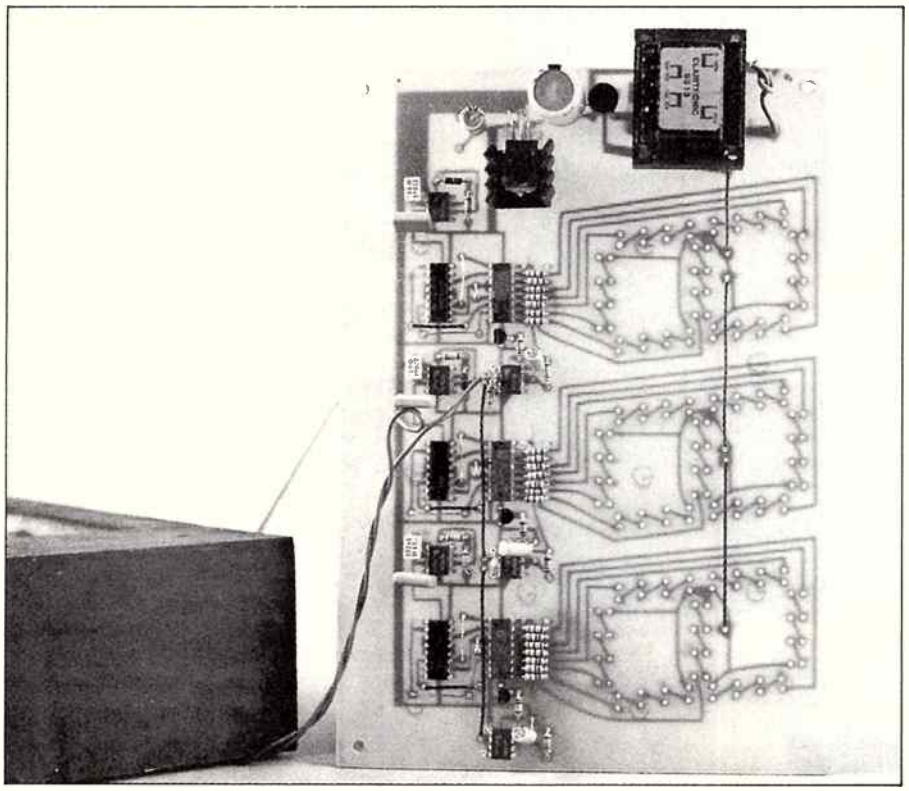
The component overlay is shown in Figure 2. Wayne advised: It is a good idea to build up the circuit a stage at a time and get it working before moving on to the next stage. Build the power supply first and once you are happy with the 12 V rail at the output of IC13, insert ICs 1, 2, 3 and their associated components.



If you have access to an oscilloscope, confirm that the outputs of IC1, 2 and 3 (pin 3) is giving a low frequency square wave (it may be possible to observe the pulses with a good voltmeter).

Connect the counters IC5, 7 and 9 and confirm operation by checking that pins 6, 11, 14 and 2 increment correctly.

Connect up the decoders IC10, 11 and 12 and all the LEDs. Note that the LEDs are connected on the reverse (copper) side of the PCB. Keep the coffee handy . . . fitting 84 LEDs the right way round needs a fair amount of concentration! Fit the associated components but omit Q1, 2 and 3 and connect temporary short circuits across the collector and emitter pads of each transis-



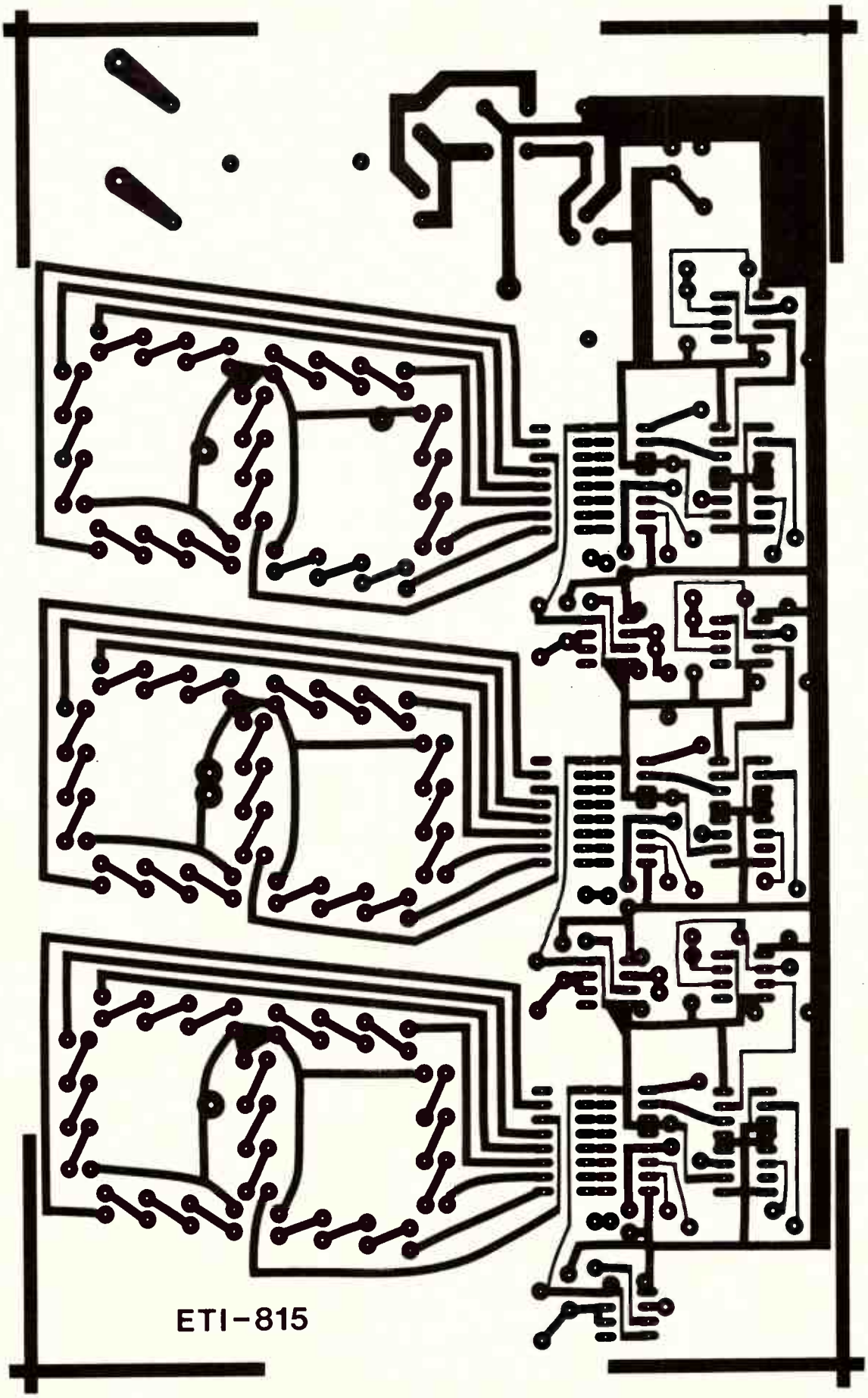
PARTS LIST — ETI-815

Resistors
All ¼W 5%
R1-6,10 ..... 270k
R7,12,14,16 ..... 10k
R8 ..... 82k
R9 ..... 180k
R11,13,15 ..... 100k
R17-37 ..... 390R

Capacitors
C1,2,3 ..... 220n polyester
C4,5,6 ..... 22µ 16 V aluminium electrolytic
C7,8,9,11 ..... 100n polyester
C10 ..... 1000µ 25 V aluminium electroytic
C12,13,14 ..... 100n ceramic

Semiconductors
IC1,2,3,4,6,8 555
IC5,7,9 4510
IC10,11,12 4511
IC13 7812
BR1 ..... 1KAB10 or similar 1A diode bridge
Q1,2,3 ..... BC548
LED1-84 ..... red 5mm LED

Miscelloneous
SW1 ..... push button
T1 ..... 15 V PCB mount mains transformer, 240 V:15 V; PI24/5VA; 400 mA
PCB. Case. Filter material. Nuts and bolts.



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READER INFO No. 40

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tor (effectively connecting LE of each decoder to OV). The LED displays should then be seen to cycle through the digits 0-9.

If one of the segments is not working, check to see that all the LEDs have been connected the right way around.

Finally connect Q1, 2 and 3, the monostable ICs 4, 6 and 8 and all associated components. The displays should then only cycle when the start button is pressed. The MSB should freeze after a time delay of approximately one second, followed by the second and third digits at similar intervals.

The finished PCB should be mounted vertically in a suitable case with a 80mm x 180mm cutout for the LED display as shown in the illustrations. The aperture should be fitted with a suitable semi-translucent filter material which allows light from the LEDs to pass through but hides the PCB copperwork and soldered joints. Professional red filter plastic is very expensive and it may be worthwhile experimenting with red cellophane or other red plastic material.

The ideal place for the start button is on the top of the box so that the operator can bring his hand smartly down on the button without fear of the box scooting across the table and into the audience (erroneous results and raucous laughter may result from such an occurrence). eti

HOW IT WORKS

The circuit diagram is shown in Figure 1. The timers IC1 2, and 3 are connected as free running astable multivibrators which generate three separate clock signals for the BCD counters IC5, 7 and 9. These counters are running continuously and asynchronously irrespective of whether the start button has been pressed or not.

The outputs of the three counters are fed to three BCD to 7-segment decoders which drive the numerical display formed by the matrix of LEDs 1 to 84. Four series-connected LEDs make up each segment of each digit. The BCD decoders have built-in latches which can store the BCD code for any digit from 0 to 9.

When the LE (latch enable) pin of the decoder is taken to logic 0, the latches are disabled and the decoder gives the 7-segment drive voltages to the LEDs equivalent to the BCD codes at their inputs A, B, C, D. The LED displays are seen to cycle through the digits 0 to 9 as the counters cycle through the BCD codes.

When the LE pins of the decoders are taken to logic 1, the latches are enabled and store the code which was present on the inputs A, B, C, D at the time of the logic 1 application. The outputs of the decoders then cause the LEDs to continuously display the number stored. The LE pins of the decoders are controlled by IC4, 6 and 8 which are connected as monostables. When the start button is pressed, all three monostables are triggered and their outputs (pin 3) go to a logic 1 which (when inverted by Q1, 2 and 3) cause the LE inputs of the decoders to be taken to logic 0. The LED displays are then seen to cycle through the numbers.

The time of the monostable associated with the most significant digit of the display is arranged to be the shortest, so this digit freezes first, then the second digit and finally the least significant digit.

The counters cycle all the time and the randomness of the number frozen is due to the completely arbitrary time when a person presses the start button. It is similar to a blindfolded person being asked to stop a wheel of fortune which is spinning very fast (but this method is much less likely to cause an accident).

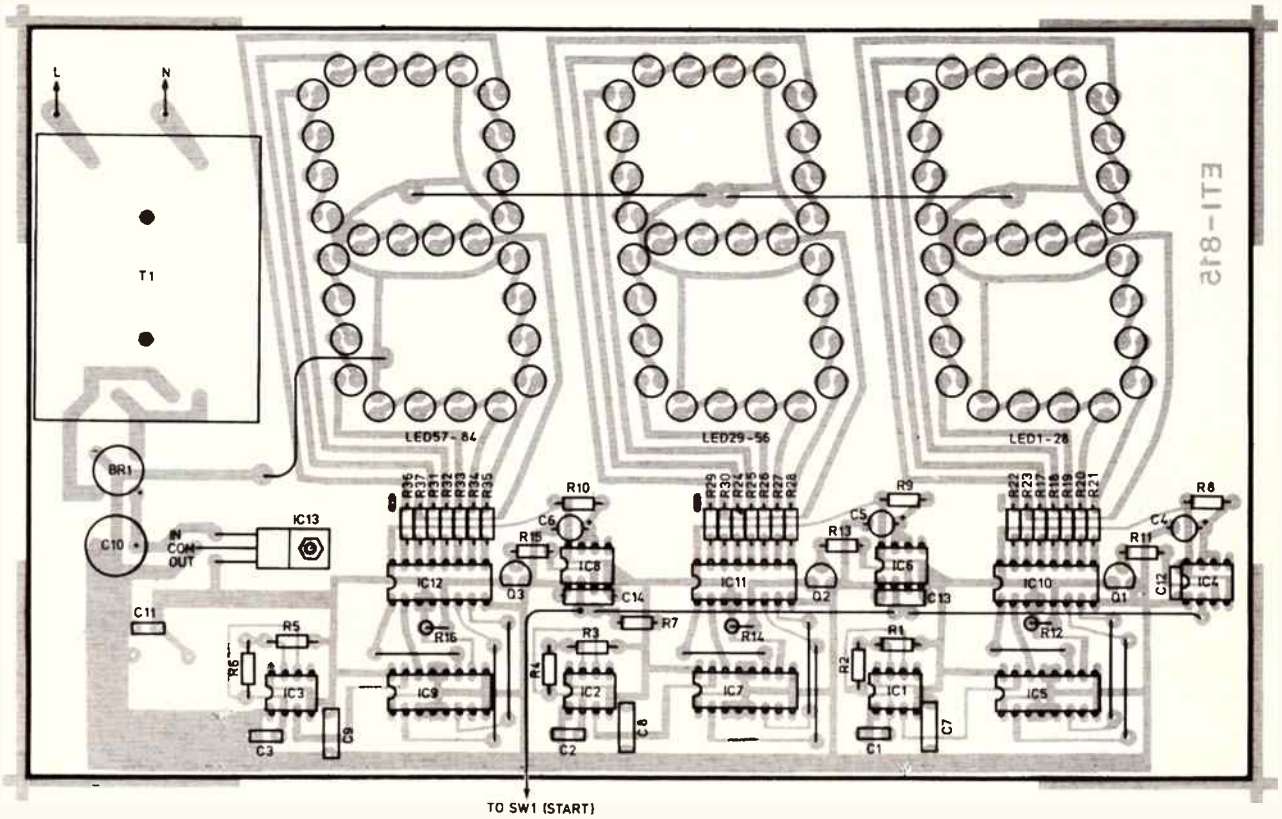


Figure 2: Component overlay of the rondom number display.

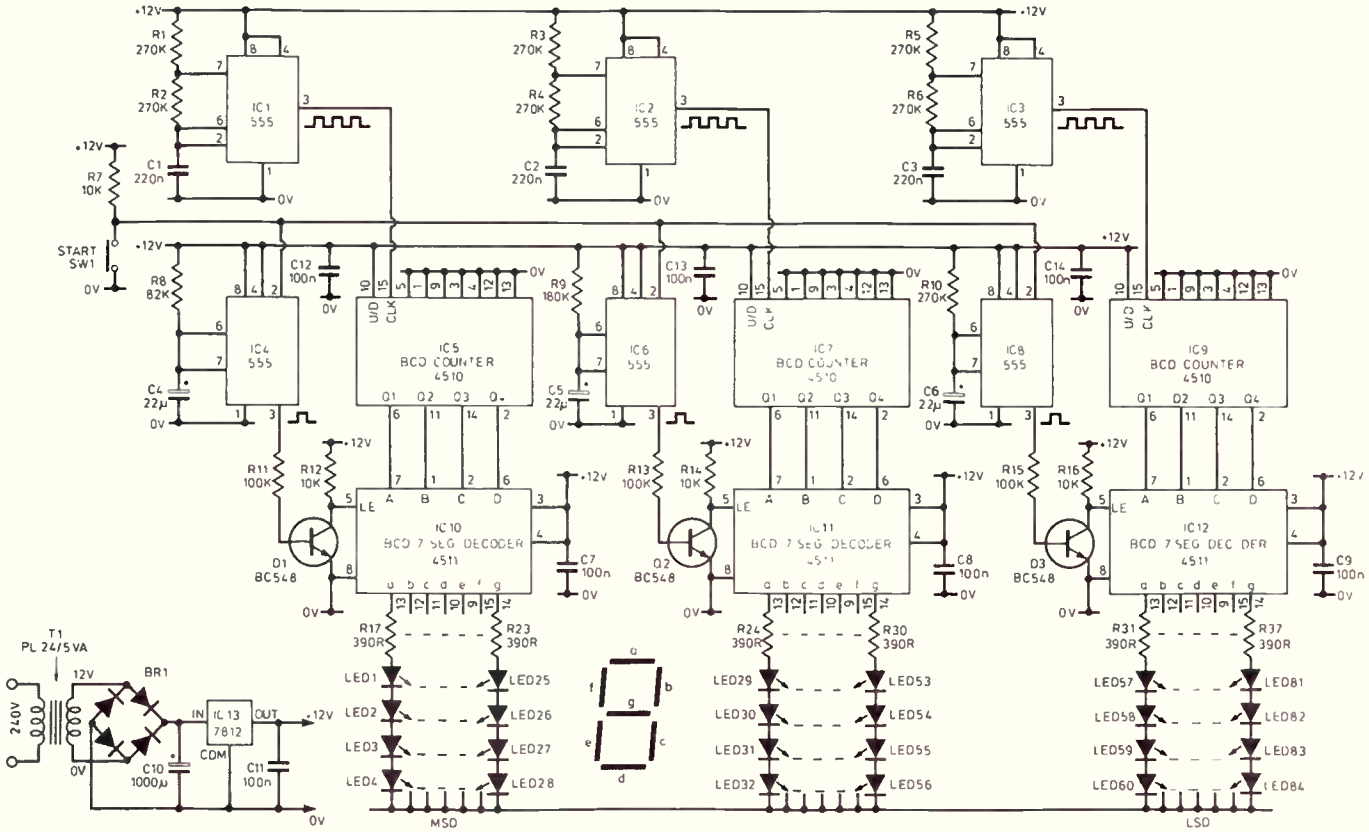
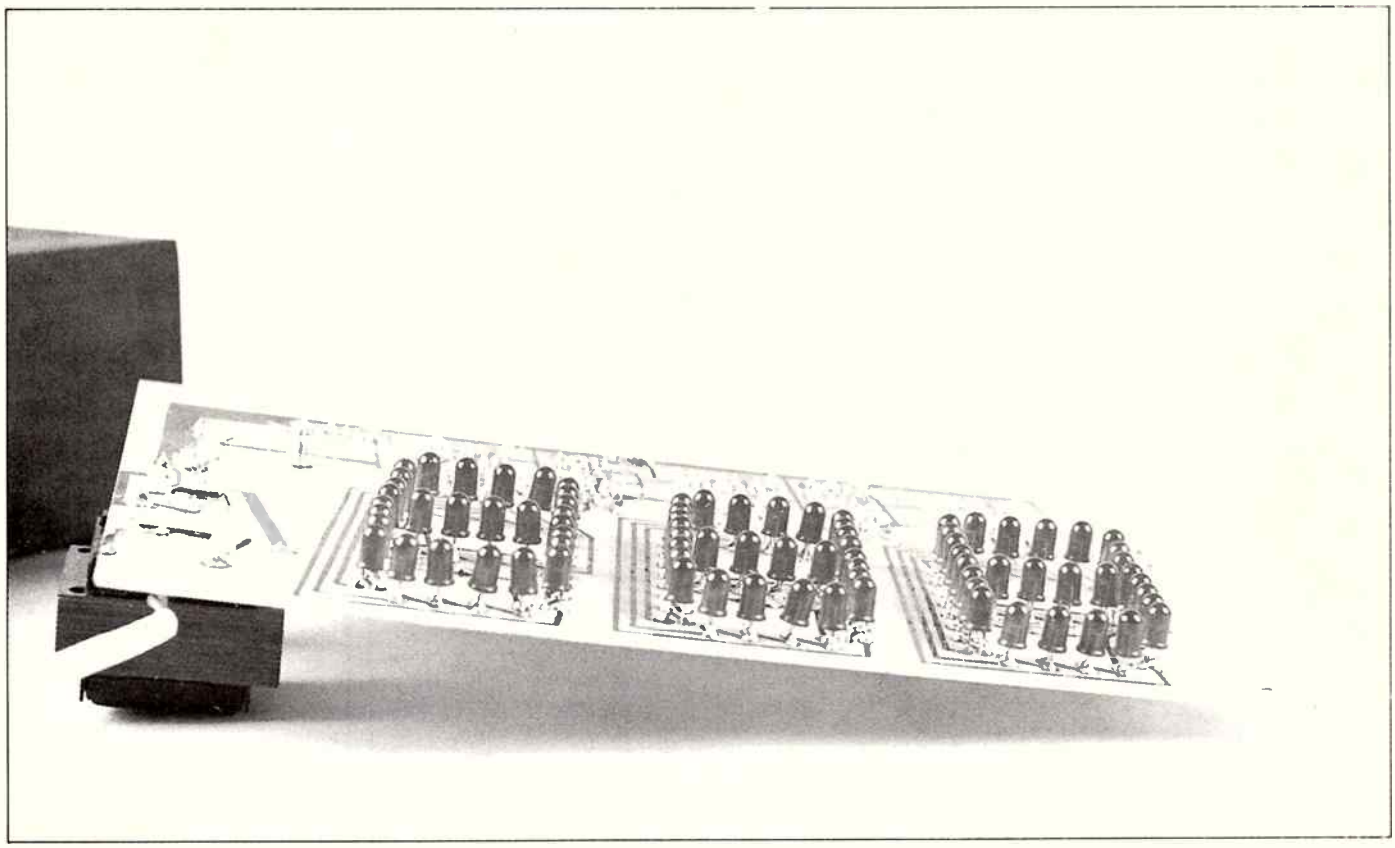


Figure 1: Circuit diagram of the random number display.



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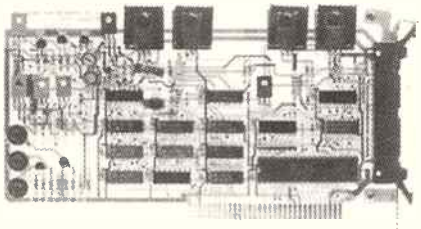
*0K RAM MEANS ZERO RAM FITTED

READER INFO No. 76

EPROM Programmer Card



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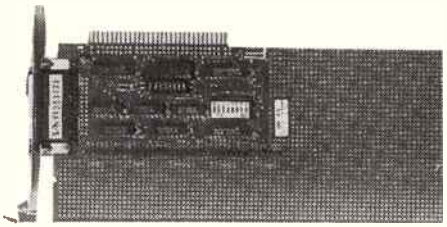

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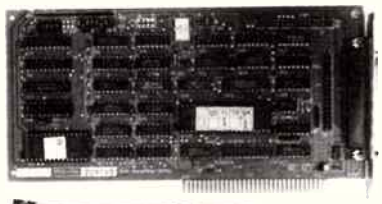

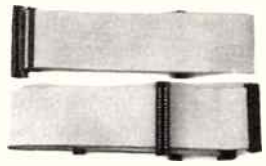

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On-Board Memory	0K RAM fitted exp. to 2M byte	1M byte fitted exp. to 4M byte	1M byte fitted exp. to 4M byte	1M byte fitted
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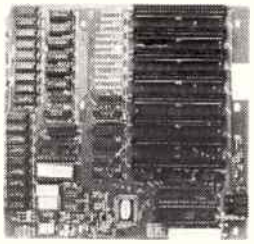

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READER INFO No. 86

ELECTRONICS
E T I - 6 1 6

Royce Craven shows how to develop MIDI interfaces for a few popular types of computer. If you own an Atari 500, Mac, Commodore 64 or Atari 1000, read on . . .

THE MANY FACES OF MIDI

Doh, re, me on a pcb

The Musical Instrument Digital Interface (MIDI for short) has been around for close to five years now. Much has been written about it and even more music written with it.

MIDI has changed the way many musicians think of electronic music. Since the 1960s, multitrack recording has been the way most popular music has been recorded. The Beatles' famous *Sergeant Pepper's* album, for instance, was a four track tour de force. Tracks were recorded on the tape while the others were played back in synchronisation.

The next step was to re-record and bounce down tracks until all the musical possibilities had been accounted for, or the signal on the tape had become distorted and too noisy.

When MIDI and the personal computer arrived, the dream of the multitrack tapeless studio finally came true. Not only that, it was cheap.

This article shows you how to build interfaces between a number of popular brands of computers and a MIDI line.

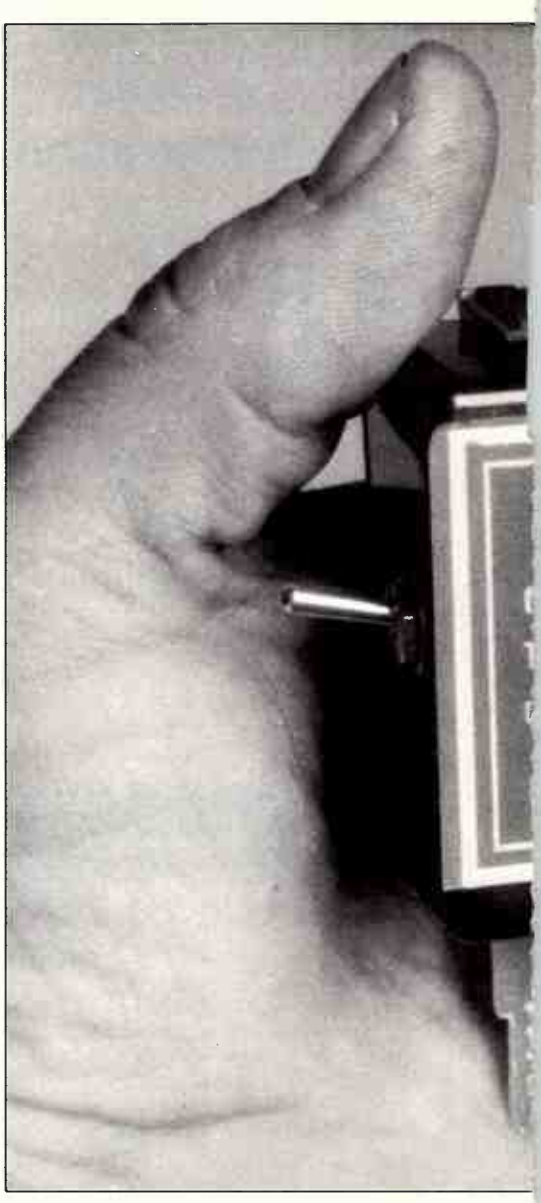
The Amiga connection

Both the Amiga 500 and the 1000 have a serial port that can generate a baud rate of 31.25K. The main difference between them is that the 1000 doesn't have a −12 volts supply on the serial port, but +/− 5 V instead. True RS232 means the received signal has to be between 3 and 25 volts for logic 0, and between −3 and −25 for logic 1.

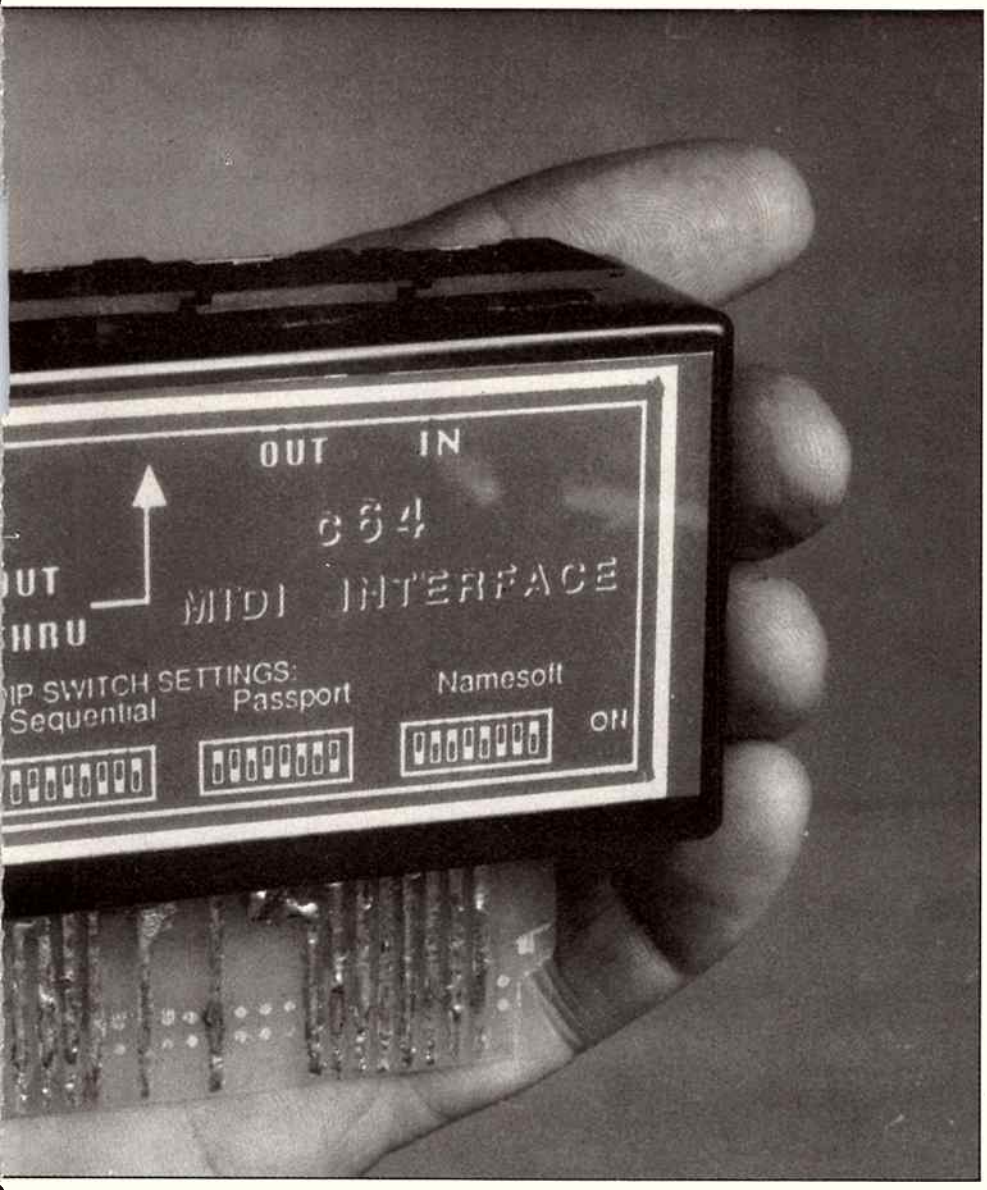
MIDI uses +5 volts for logic 0 and 0 volts for logic 1, so all that is really needed is some kind of buffering (and something to modify −12 and +12 volts on the RS232 to 0 and +5 volts for MIDI and the reverse for the receive port). An opto-isolator is needed to prevent ground loops in the system (Figure 1). This is part of the MIDI standard and must be adhered to.

As the interface is very simple it was decided to make it as cheap and small as possible. The board will accommodate the DIN plugs, so there are no flying leads.

When recording music into a sequencer you might want to hear the notes you are playing generated on a slave synth. So you need to be able to connect the controlling keyboard to the slave synth. During playback you would have to re-connect the slave synth to the OUT port of the computer. Some interfaces (such as our C64 interface) have a switchable "Thru/Out" MIDI port. As the Amiga is very fast, the need for a MIDI thru port seemed unnecessary. Most Amiga software developers seem to agree, and a software generated THRU function is usually included. This echos the incoming MIDI



For a complete understanding of the MIDI, read ETI October 1986 p 18 ff. This article by Neale Handcock looks at the standard in some depth. ETI has published a number of DIY articles on MIDI that might also pay inspection. For instance, see March 1986, p 51, May '87, p 50, November 1987, p 94, November '88, p 100.



Next month: we cover the Commodore 64 MIDI interface.

information via a software loop and stuffs it out the MIDI OUT part.

Construction

Solder the connector into place and then the LM78L05 and the filter capacitor. Check that they are connected round the right way and that there are not bits of solder connecting the tracks of the printed circuit baard. With the pawer off, plug the interface in and then turn on the power. Check the output of the regulator with a voltmeter. If it is anything other than very close to +5 volts, quickly turn off the Amiga and check the orientation of the regulator and the capacitor and that there are no solder bridges.

If this part of the interface is working, the rest of the construction should be fairly simple.

For the Amiga 1000, leave the LM78L05 out altogether and solder a link from pin 21 (+5 volts) to where the output pin of the LM78L05 would have been. Also, on the Amiga 1000 connect pin 21 (−5 volts) to the donut near pin 10 of the RS232 plug. The connection between pin 1 and pin 7 should be cut. Pin 7 should be left connected to ground on the interface.

On bath computers, follow the overlay and make sure the two diodes, the opamp and the opto-isolator are soldered the correct way around.

As the 6N138 opto-isolator is quite expensive, you might like to solder in an 8 pin socket and then just slip the IC in. This will make servicing the interface much easier as the board has many very thin tracks (so it would fit into the headshell) and it won't stand much in the way of repeated soldering.

The Macintosh connection

The second interface is for the Apple Macintosh. It is similar to the Amiga interface, but as the Mac has two serial ports, this project has two complete interfaces built into it.

In the USA, the Mac has become one of the industry standards for music production and audio post-production.

As a result, the music software for this machine is very flash, if somewhat expensive (I guess if you can afford the machine, you can afford the software), and takes advantage of the flexibility and speed of the Mac. It's not as fast

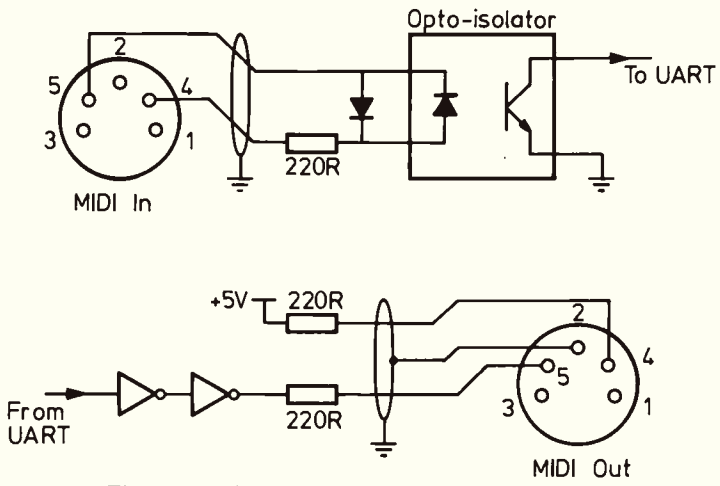


Figure 1: The opto-isolator board.

as the Amiga due to the Amiga's parallel processing, but it has a lot of very good software already written for it.

Inside the Mac

The Apple Macintosh has two serial ports. Both would be capable of driving MIDI except for one thing: unlike the Amiga the internal clock rate of the Mac won't go fast enough to drive the 31,250 baud rate of MIDI. What the Mac will do, though, is let you apply an external clock and then divide it down to the required baud rate.

Many programs now take advantage of both the two ports and allow you to connect two MIDI interfaces. At first this might seem a bit excessive, but once you have a lot of MIDI information (notes and patch changes as well as timing pulses, MIDI song pointer and information for automated mixing) the one MIDI port gets choked very quickly. This causes timing delays, chords being arpeggiated, as well as problems with synchronisation to other equipment.

The first thing that is needed is a clock to drive the serial ports. A 1 MHz clock is fast becoming the Macintosh standard. A crystal controlled clock is easily constructed out of three TTL inverters. The other three in the pack can be used to buffer the MIDI outputs.

On the original Macintosh (the 128 and the 512), the serial ports were normal nine pin and D connectors with the pin out as shown in Figure 3. On the Mac Plus all this changed, of course,

HOW IT WORKS

The Amiga interface

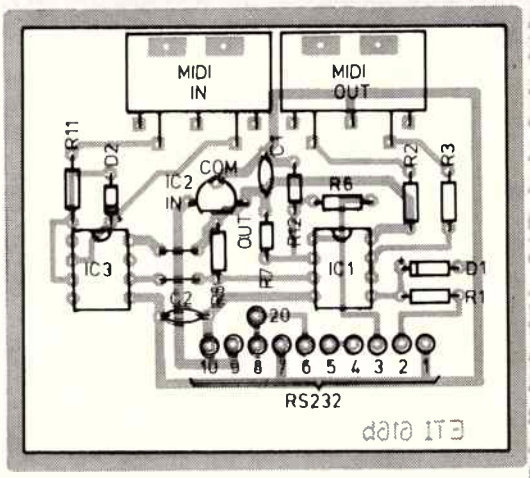
The interface can be divided into three sections: power supply, output and input.

The power supply is derived from the ±12 Vdc pins supplied by the Amiga's RS232 port. The +12 volt supply is regulated to TTL's +5 Vdc by a three pin voltage regulator IC2. As very little power is needed, the low power and physically small 78L05 is used. C1 and C2 are there as smoothing capacitors and to prevent the regulator from oscillating.

The digital MIDI signal coming out of pin 2 on the RS232 is +12 volts for the OFF state and -12 volts for the ON state. MIDI uses +5 volts for the OFF state and 0 volts for the ON state. R1 and D1 clip the negative going signal so the ON voltage is very nearly 0 volts. IC1a is half a dual op-amp, set up as a voltage follower. As it is supplied by +5 volts, presenting a voltage of 5 volts or above to the non-inverting input simply holds the output to the 5 volts of the positive supply. R3 and R2 are current limiting resistors defined in the MIDI 1.0 spec.

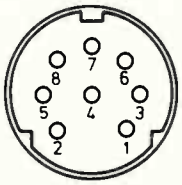
The MIDI input signal is fed into an opto-isolator network with current limiting and reverse voltage protection as defined by the MIDI 1.0 spec. Remembering that +5 volts is the OFF state, the output (pin 6) of the 6N138 has a pull up resistor R8 and is then fed into the non-inverting input of IC1b.

R12 and R6 provide a gain close to 2 for the +5 to 0 swing of the MIDI signal. This would normally provide a +10 to 0 volt output. As the output needs to be within the RS232 range of +25 to +3 volts for the OFF state and -25 to -3 volts for the ON state, a DC bias is added. R7 and the feedback resistor R6 cause the output from R7's input to be inverted with unity gain. As R7 is connected to +5 volts the output from this network would be -5 volts. Adding the two values gives a swing of nearly +5 to -5 volts for our MIDI signal of +5 and 0 volts.



Amiga pcb: component side.

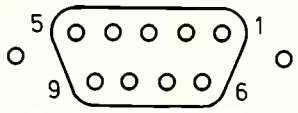
Macintosh Plus Serial Pinouts



1. DTR handshake out
2. DSR handshake in
3. TX-
4. Signal Ground
5. RX-
6. TX+
7. Not Connected
8. RX+(Ground this line for RS232)

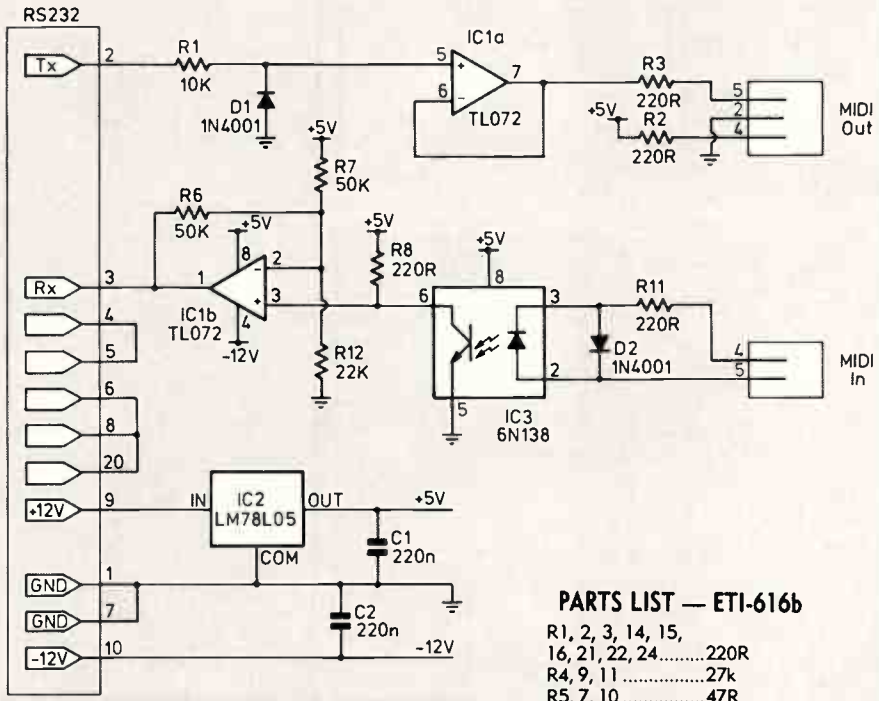
Figure 4: Mac Plus pin outs.

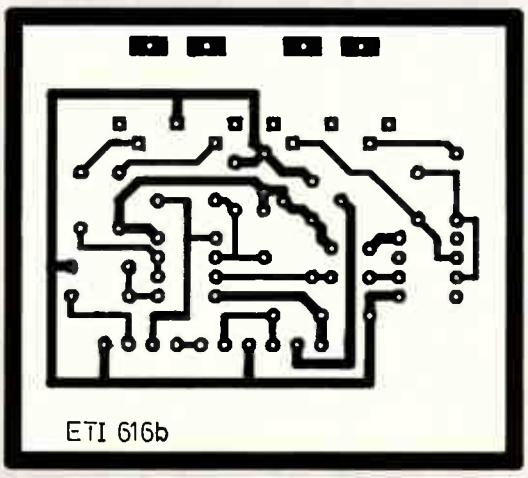
Mac 128 or 512
Printer / Modem Port



1,3. GND
2. +5V dc
4. Tx+data
5. Tx-data
6. +12V dc
7. CTS/Ext Clk
8. Rx+data
9. Rx-data

Figure 3: D connector pin out on the original Mac computer.





Amiga pcb: solder side. ETI-616

PARTS LIST — ETI-616b

R1, 2, 3, 14, 15, 16, 21, 22, 24	220R
R4, 9, 11	27k
R5, 7, 10	47R
R6, 8, 12	470R
R13, 19, 20, 23	10k
R17, 18	680R
C1, 2	220µ/25V
C3, 4	10µ/10V
C5	10µ/16V
C6	2n
C7	10n
C8, 9, 10, 11	470p
D1, 3, 4, 5	1N4001
D2, 6, 7, 8, 10, 12	1N914
D7, 11	Midi RX LED
D9, 13	Midi TX LED
Q1, 2, 3	BC559
Q4, 5	BC544
IC1, 2	6N138
IC3	LM7805
IC4	LM7905
IC5	74L504
IC6	4049
XI	1 mHz XTAL
TI	12 Vac 300µA

and they deleted a few things like the +12 volt and the +5 volt pins. (see Figure 4). So to make the design usable by all Macs, the interface will have to power itself. You can have the choice of using a 12 Vac plugpac or the 12 Vac transformer that I used. The rest of the power supply is on the main interface board.

The serial port switcher

As the Mac uses its serial port as its only printer port, using both the ports for the MIDI interface means that you have to swap cables back and forth all the time to print anything. Moreover, if you have a sampler such as an Emax and you possess the editing software to go with it, there is another cable to be swapped for the MIDI lead. This system uses a high speed (500K baud) serial data transfer to pass the digital sound data to the Mac.

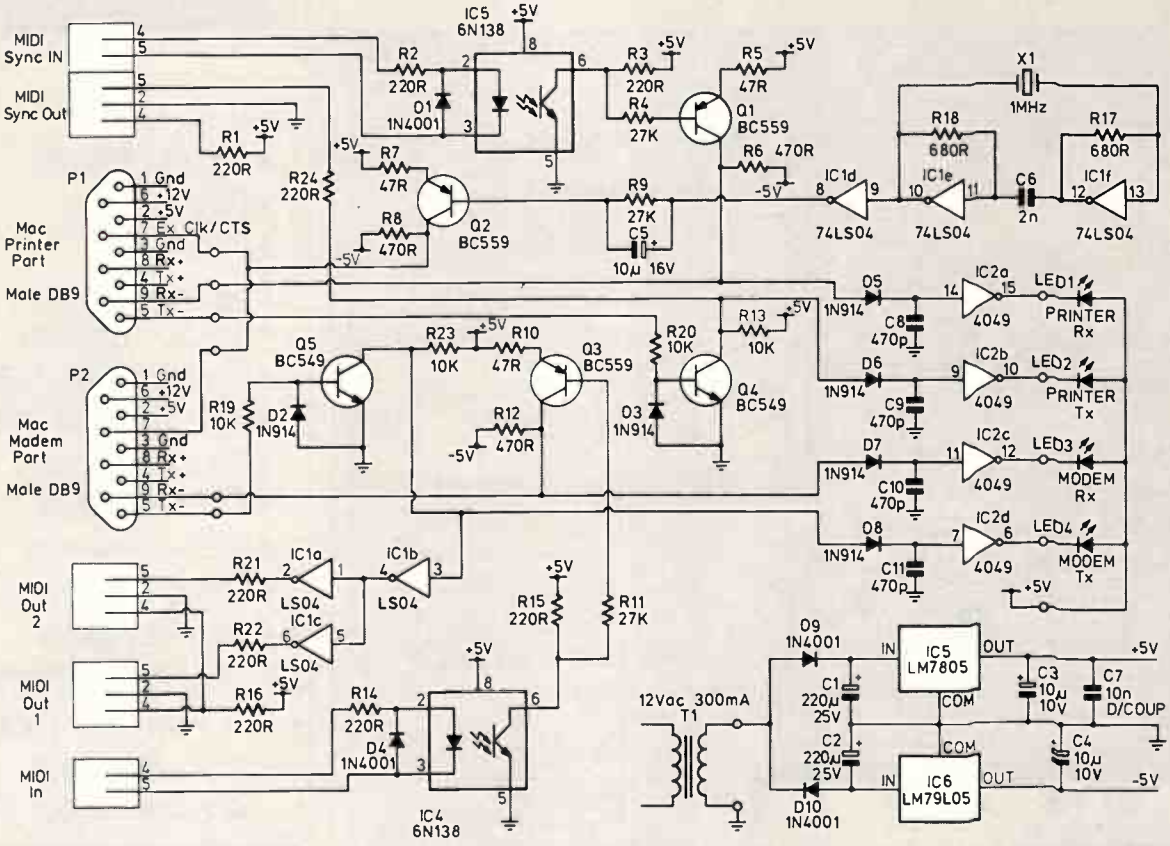
To resolve this problem I have designed a simple switching circuit for the serial port. It is a 1 into 3 port using a simple switch and has LED indicators to show what's connected.

It was built on a seporate board, so if you're interested let me know and I'll send you the details.

My interface was built into a small case that fits under the Mac. There are two ports and it takes very little imagination to see why Apple only gave out one cable. The other cable cost me a staggering $38.00. If you find the DIN plug here is how to wire it up:

Mini DIN-8 Male	Mini DE-9 Female
1	6
2	7
3	5
4	1&3
5	9
6	4
8	8

When designing this interface I was asked to install some LEDs that would



HOW IT WORKS

The Macintosh interface

This interface is really two interfaces on one board. Although the interfaces look very different they have similar MIDI circuits.

The MIDI input is presented to the current limiting and reverse voltage protection circuit (R14,D4 and R2, D1) before going into the 6N138 opto-isolators. These components are part of the MIDI 1.0 spec.

The output of the opto-isolator has a pull up resistor and is then fed to an inverting transistor switch (Q1 and Q3). It is biased in such a way as to give a negative voltage below -3 volts for the OFF state and a positive voltage above +3 volts for the ON state.

This signal is fed to the inverted receive pin on each of the serial ports and to the LED display circuits.

The MIDI signal sent from the inverted transmit pin of the RS232 on the Mac is clipped by the resistor diode combination (R19,D2 and R20,D3) to prevent negative going signals to the inverting switch (Q4 and Q5). The output of the Q4 switch is sent to the MIDI out port via R24 for current limiting as is indicated in the MIDI 1.0 spec.

The output of Q5 is sent to IC1b, a TTL inverter. The output of this is fed to the inputs of two more inverters in the same package to reinvert the signal and provide two identical

flash when there was any MIDI information being sent or received.

The design uses the more normal small signal transistors for the input and output instead of the opamps. It's a little cheaper, but uses more space on the printed circuit board.

Sticking it together

As with the Amiga interface, the Mac is an expensive piece of equipment to connect faulty equipment to.

Power supply problems can cause disasters in the rest of the circuit (usually the part that was working perfectly) and you should get this stage up and functioning first. Put the diodes, regulators and the electrolytic capacitors in the correct way — check the overlay. Connect the 240 V power lead to the fuse and then to the transformer. When all looks well have another look and check that the parts are put in the correct way and that there are no solder bridges (solder blobs across the printed circuit board tracks). When you are sure everything is OK, plug the power lead into the power point and check to see if the LM7805 is supplying +5 volts and the LM7905 is supplying −5 volts with the aid of a voltmeter (a multimeter is the minimum test gear that you should have when fiddling around with the hardware side of computers).

If all is OK, then you can either go gung ho and finish it all, or you might like to try to build the oscillator and one of the MIDI ports. Building the circuit in blocks will make fault-finding a lot simpler.

Assuming that no smoke results, the interface should be functioning. Connect a MIDI device to the MIDI input and watch the LED flash. Then you might borrow some software for the Mac (like your best friend's sequencer software) and test that all is working OK.

Unfortunately there is no *simple* way to program a test routine into the Mac. If anyone can supply one I will gladly pass it on. **Eti**

MIDI outputs.

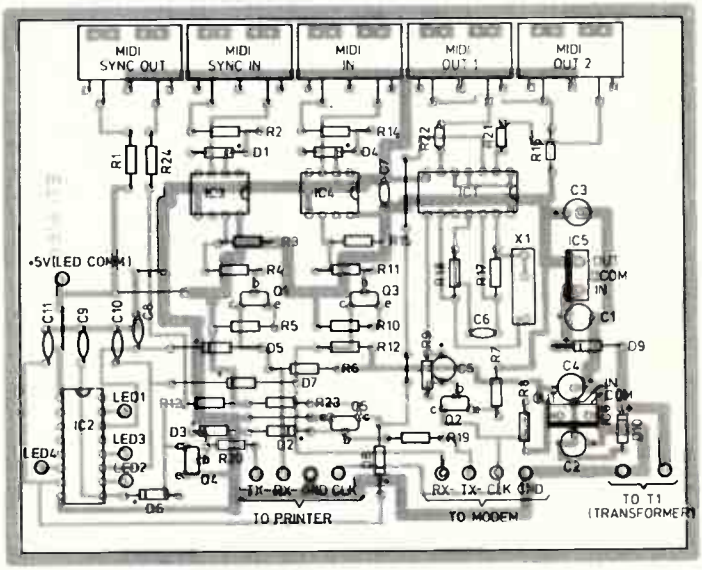
The four LED display circuits are identical. The digital signal is sent to a blocking diode (D5,6,17,18). When the signal is positive, current flows and charges up the capacitor (C8,9,10,11). When the signal is low, the current can't flow back through the diode and the CMOS inverters have a very high impedence, so the voltage on the capacitor remains for some time. In this way it is possible to see a block of data. The 31.25K baud is too fast to be seen as is.

The output of the CMOS inverter goes low when the capacitor is charged and so current flows through the LEDs lighting them up. A low voltage on the input of the inverters gives a 5 volt output, so each side of the LED has the same voltage and no current flows.

The Mac needs to be clocked externally to transmit at such a high speed as 31.25K baud, so a 1 MHz crystal-controlled TTL oscillator is used. The propagation delay between inputs and outputs of IC1e and IC1f is determined by R17,18 and C6. The crystal X1 locks the osillations to a frequency of 1 MHz.

The output of the clock is sent to an inverting switch (Q2) similar to the MIDI input switch and provides a RS232 compatable signal. The main difference is the capacitor C5 which is a *speed up* capacitor allowing the transistor to switch at the required 1 MHz.

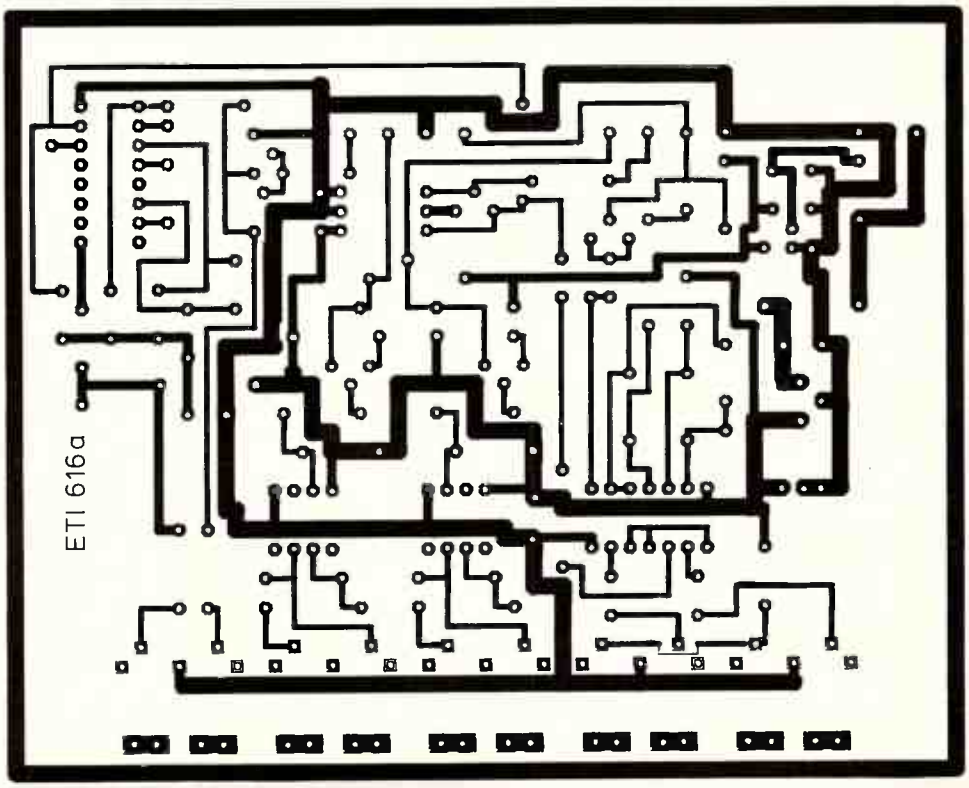
The power supply is conventional and cheap. The two diodes D9,10 along with the smoothing capacitors C1,2 form a voltage doubler. This is fed into positive and negative 3 pin voltage regulators. The output of these regulators have capacitors to prevent oscillation.



ETI-616a: component side.

PARTS LIST — ETI-616a

R1	10k
R2, 3, 8, 11	220R
R6, 7	50k
R12	22k
D1, D2	IN4001
C1, C2	220n
IC1	LM78LOS
IC2	6N138
IC3	TL072



ETI-616b: solder side.

E T I - 1 5 3 9
ELECTRONICS

Here is an ETI project by Keith Brindley which may help you find that valuable coin in your own backyard or save you from putting the axe into that waterpipe which looked so much like a tree root . . .

FIND SOME TREASURE OR AVOID A TRAGEDY

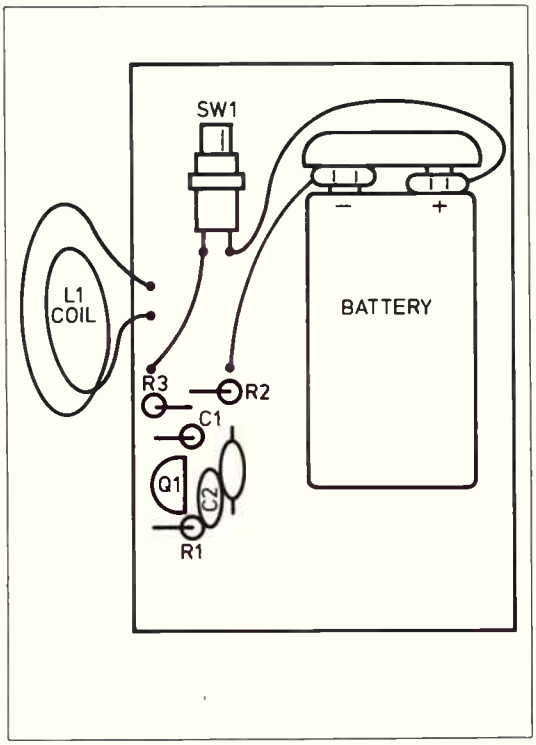
Turn your tranny into a metal detector

Although this metal detector is certainly small, it does require a few extras. You don't need a car battery for power, a rucksack (to put it all in) and a six-foot dipole aerial to make the project work but you do need a small transistor radio.

The metal detector works by transmitting a weak radio wave carrier signal around itself, which has to be picked up with a nearby tranny.

The carrier signal main frequency is in the vicinity of the lower end of the long-wave band (around 120 kHz) and is of sufficient strength to interfere with a normal am band radio within abaut a foot or so, tuned into the medium or long wave. The interference is heard as a whistle from the radio's loudspeaker. As the whistle changes frequency, you know the metal detector is approaching a metal or metal-like object.

Sensitivity is pretty good considering how simple the project is. With a remote pickup coil metals can be detected from a distance of 150 mm or so. Even when the pickup coil is mounted on the project's case (as ours is) metals can be detected from around 100 mm.



The component overlay for the Metal Detector PCB

'Sensitivity is pretty good considering how simple the project is'

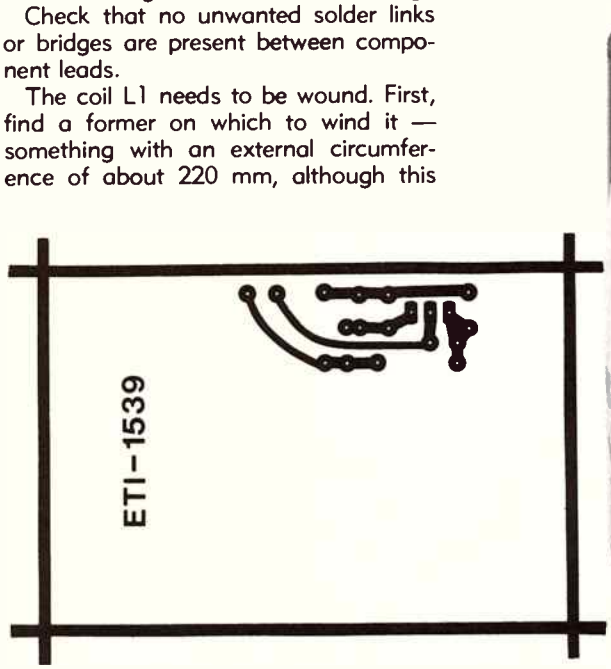
Construction

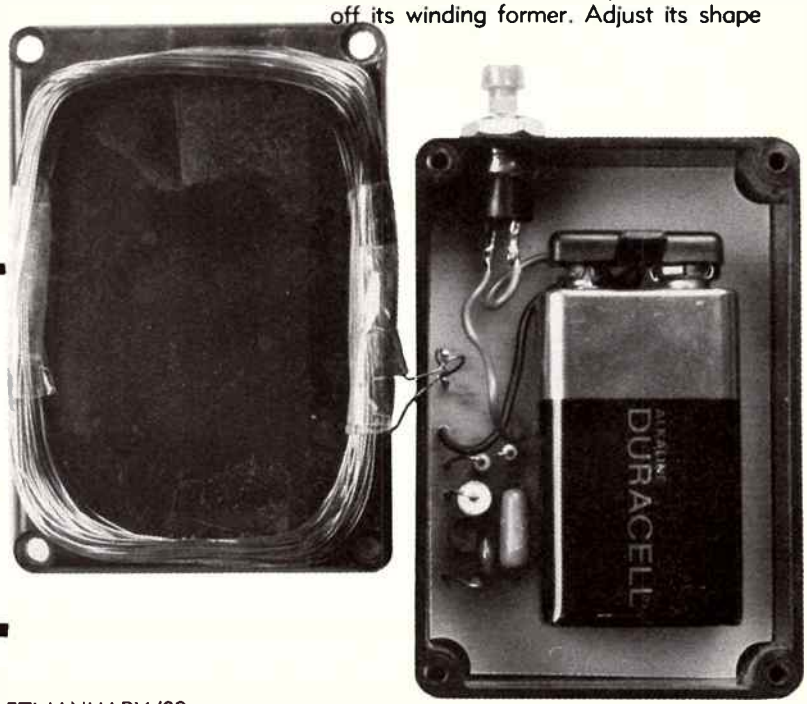
Construction needn't follow any particular order, although it's probably best to leave the transistor and coil till last. Whatever, go easy on the heat. Solder only one leg of each component at a time then leave the component to cool before moving on to solder the next leg.

Check that no unwanted solder links or bridges are present between component leads.

The coil L1 needs to be wound. First, find a former on which to wind it — something with an external circumference of about 220 mm, although this measurement is by no means critical. For reference, we used a tapered bottle, allowing us to pick that part of the taper which made the right circumference. Alternatively, a piece of thick card about 110 mm long could be used to hand-wind the coil. Make 100 turns of 30 swg enamel covered copper wire, leaving sufficient ends to connect between the coil's final positin and the PCB.

When you've would the coil, fasten it together in two or three places around its circumference with tape and slip it off its winding former. Adjust its shape





What's the greatest threat facing the computer today?

Australian and American experts agree on what it is, although their estimates of how much it costs you in downtime varies. Americans believe it accounts for more than 30% of all computer failures. Yet some Australians say their practical experience leads them to believe 70% would be a far more accurate figure.

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READER INFO No. 62

PARTS LIST - ETI - 1539

Resistors (all ¼ W, 5%)
R1 ..... 150r
R2, 3 ..... 33k

Capacitors
C1 ..... 10µ 16V axial electrolytic
C2 ..... 2n2 ceramic
C3 ..... 100n ceramic

Semiconductor
Q1 ..... BC182L

Miscellaneous
SW1 ..... Push-to-make
L1 ..... Hand-mde coil (see text)
PCB. Case. Type PP3 battery and clip. 30swg enamel covered copper wire for coil L1.

to suit.

Before you solder the ends of the coil into the PCB, make sure you scrape off the enamel from the copper wire for about 5 mm from each end, so they can be soldered. If you are using polyurethane coated insulated copper wire, there is no need to scrape off the insulation

'. . . a fortune buried in the compost heap'

as the copper is self-fluxing on application of heat from a soldering iron.

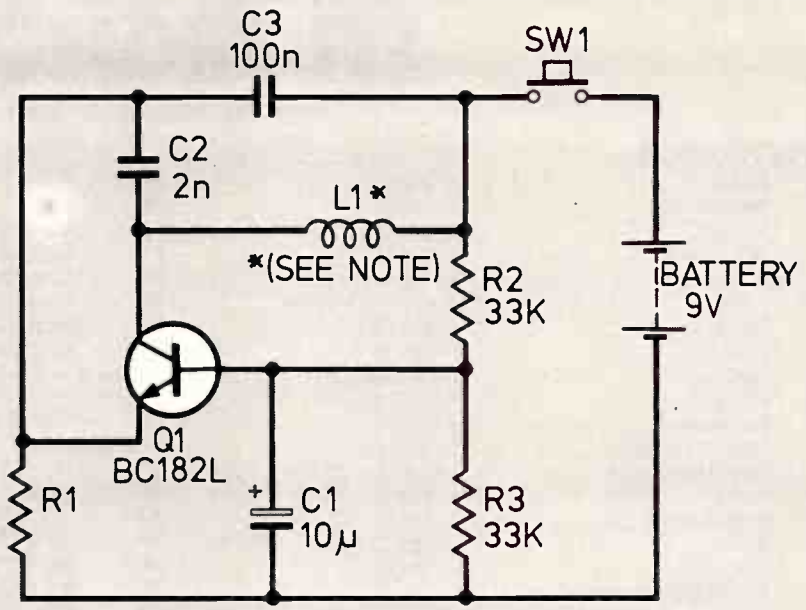
Any suitable sized box can be used to house your project, although the PCB is exactly the right size to fit the box used. The only real precaution you need to take is to mount the coil on the outside of the case (if it's on the inside its inductance is fixed primarily by the PCB and associated components — not by metals you wish to detect!) or better still, remotely.

Setting up

Setting up is simplicity itself. Turn on your radio and, while you press the metal detector's push-button on/off switch, adjust the radio's frequency tuning control until you hear a whistle. When you release the push-button the whistle should stop. If not, the whistle isn't caused by the metal detector and you should re-adjust the radio's frequency tuning control.

Test the metal detector by moving it closer to metal. The whistle from the radio will change frequency.

Now you're all set to find your fortune buried in the compost heap in the back garden. eti



NOTE:
L1 = HAND MADE (SEE CONSTRUCTION)

HOW IT WORKS

The circuit is a Colpitt's oscillator, formed around transistor Q1 which is connected as a common base amplifier. Positive feedback is applied from collector to emitter via the ac potential divider formed by series connected capacitor C2 and C3.

Capacitors C2 and C3 also form one arm of a parallel LC circuit. The circuit's resonant frequency is given by the relationship:

$$f = \frac{1}{2\pi\sqrt{(LC)}}$$

and is around 120 kHz. Conversely, we can calculate from the relationship that the coil inductance is around 0.88 mH. Try it for yourself.

Coupled in this way, the transistor amplifier becomes a weak radio transmitter, transmitting a carrier wave frequency of around 120 kHz. Now, this is actually slightly below the frequencies which are normally found on the dials of long and medium wave radios (long wave is typically from about 150 kHz to 300 kHz and medium wave is from about 500 kHz to 1600 kHz). This means that if the metal detector's transmitted carrier was pure, long wave and medium wave radios could not be used to pick up the oscillations. Fortunately, oscillations are not of a pure sine wave nature, so many harmonics of the resonant frequency are also formed, going right up through the long and medium wavebands and beyond.

The project functions as a metal detector simply because the actual inductance of the resonant frequency's coil varies with the proximity of local metallic bodies. Ferromagnetic bodies particularly concentrate the magnetic flux within the coil, so increasing the coil's inductance and lowering the resonant frequency of the oscillator.

A local transistor radio is used to pick up the weak carrier signals produced by the metal detector, along with a carrier wave of another radio transmission (of a more legal, broadcast nature). The two carriers heterodyne (interfere) to produce an audible beat frequency from the transistor radio's loudspeaker. The beat tone is stable, until a metal object approaches the metal detector's coil. Then the coil's inductance varies, causing the resonant oscillation frequency to vary and in turn causing the beat tone to vary. So the user hears, simply by a change of the beat tone's pitch, that the coil is somewhere near a metal object.

ETI PROJECTS

June 1971-December 1988

SIMPLE PROJECTS

No.	Name	Date
043	Heads or tails	Oct 76
044	Doorbell	Oct 76
061	Simple amp	Oct 76

On page 64 the negative lead from the 9 volt battery to the Veroboard (Fig. 2) should be connected to the copper track above that shown, i.e. to the track marked 'common'.

062	Simple AM tuner	Mar 77
064	Intercom	Nov 76
066	Temp alarm	Dec 76
068	LED dice	Oct 76
070	Tie breaker	Jan 77
071	Tape noise limiter	Jun 78
072	Two octave organ	Jun 78
081	Tacho	Mar 77
084	Revised Car Alarm	Oct 87
801	LINC	May 75
802	Windicator	Feb 75
803	Cannonballs and missionaries	Dec 75

In Fig. 2 on page 101 the line joining the contact M3d to the buzzer common line should be deleted. Switch M3d should be normally open. On page 102 Fig. 5 a connection should be made between the bottom-left contact of M3 and the bottom-right contact of M1.
For those who built this project and think that it cannot be solved — and for those still struggling with the problem on bits of paper — here's a solution.
M means any missionary. C means either of the non-rowing cannibals. C2 means the cannibal who can row.

1. C and C2 go over
2. C2 comes back
3. C and C2 go over
4. C2 comes back
5. M and M go over
6. M and C come back
7. M and C2 go over
8. M and C come back
9. M and M go over
10. C2 comes back
11. C and C2 go over
12. C2 comes back
13. C and C2 go over

804	TV game	Nov 76
805	Drunken sailor	Oct 77

COMPONENT AND KIT SUPPLIERS

These suppliers should be able to assist you to locate electronic components for ETI projects.

All Electronic Components (03) 662-3506
Altronics (09) 381-7233
Dick Smith Electronics (02) 888-3200
Energy Control (07) 288-2455
Electronic Discounters (08) 212-1799
Force Electronics (08) 212-2672
Geoff Wood (02) 427-1676
HI-Com Unitronics (02) 254-7878
Jaycar (02) 747-2022
Laser Electronics (075) 532-2066
Magraths (03) 663-1122
Prepak (02) 569-9797
Rod Irving Electronics (03) 663-6580
Rifa (008) 334-832
Rockby Electronics (03) 562-8559

Circuit boards and some front panels are available from the following:
Jemal (09) 350-5555
RCS Radio (02) 587-3491
All Electronic Components (03) 662-3506

The following services are available direct from ETI:
Artwork for all our projects: $5 for boards up to 10 cm, $10 for larger boards.
Back issues of available: $4
Photocopies of articles: $4, or $8 if more than one part.
Send orders to **Reader Services, ETI magazine, 180 Bourke Road, Alexandria NSW 2015. Sydney, Australia.** Please note that phone orders cannot be accepted.

No.	Name	Date
806	Skeet	Jan 78
807	Tub o'war	Aug 84
810	TV game	Jun 78
811	Tank game	Oct 78
812	Wheel of fortune	Dec 78
813	Race track	Jan 79
814	Electronic dice	Aug 79

Capacitor C2 is shown with the wrong polarity on both the circuit and the overlay. Also, C1 and C2 are incorrectly listed in the parts list. C1 is a 10µF tantalum.

824	Slot car controller	Dec 81

The power transistor. Q1 is an MJ2955, not a 2N2955. On the overlay, page 29, R3 is shown as 830R, but is really 820R, as in the circuit and parts list.

905	Organ	Jan 83
918	Polyphone light beam transceiver	Sep 82
201	Current limiter	Apr 71
202	Stereo balance meter	May 71
203	10 c moisture meter	Jun 71
204	Elapsed time indicator	Aug 71
205	Doorbell	Sep 71
206	Audio visual metronome	Oct 71
207	Emergency lighting unit	Oct 71
208	Loudhailer	Nov 71
209	Meter mount	Oct 72
210	Decision-maker	Jan 73
211	Audio frequency meter	May 73
212	Earth resistivity meter	May 73
213	The revealer	Jun 73
215	Cyclone detector	Nov 73
216	TV ghost eliminator	Feb 74
217	12 V power supply	Feb 74
218	Mono organ	May 74
219	Hee-haw siren	May 74
220	Wailing siren	May 74
221	Basic power supply	May 74
222	Transistor tester	May 74
223	Multi vibrator	May 74
224	Temp alarm	May 74
225	Simple amplifier	May 74
226	Temp meter	May 74
227	Crystal radio	May 74
228	Pocket metronome	Aug 74
229	Metre beater	Nov 74
230	The family ferry	Sep 74
231	Flip-flop flasher	Jan 75
232	Courtesy light reminder	Oct 74
233	Combination lock	Oct 74
234	Intercom	Oct 74
235	Bicycle speedo	Mar 75
236	Code practice oscillator	Aug 75
237	Loudness control	May 75
238	Headphone adaptor	Dec 75
239	Breakdown beacon	May 76
240	High power rescue signal	May 76
241	electronic dice	Jul 76
242	Neo nim	Aug 76
243	Pip beacon	Apr 77
244	Car alarm	Feb 77
245	White line follower	Nov 77
246	Rain alarm	Apr 78
247	Soil moisture indicator	Nov 80

There is an error in How It Works on page 52. The circuit on Figure 3, lower right, shows the zener the wrong way round.

248	12 V-22 V converter	Jul 78
249	Combination lock	Apr 79

No.	Name	Date

First of all, scrap Table 1 and the associated copy above it. Secondly, have faith in the 'How it Works', for it is correct.
The connections to SW1 and SW2 on the circuit and incorrect. Pin 8 of SW1 goes to C(R8). Pin 1 of SW2 goes to D(D2). Pin 4 of SW2 goes to E (C8, R9 and gate of SCR3). Pin 11 of SW2 goes to F (C6, R6 and gate of SCR2). Note that H on the overlay is point K on the circuit.
Overall, dialling the sequential code on SW1 and SW2 should connect, in sequence, B-D, then A-F, then C-E. Work out your code appropriately.

250	House alarm Incorrectly labled ETI-262	Aug 80
251	Op-amp power supply The overlay is reversed. See Sept 85 p9.	Aug 85
252	Passionmeter	Apr 85
253	Grenade/hot potato game	May 79
254	Egg timer	Jun 79
255	Temperature meter	Nov 80

The meter in the circuit diagram on page 39 was shown the wrong way round. The negative terminal of M1 goes to pin 2 of the LM3911.

256	Humidity metre/controller	May 81
257	Universal relay board	May 81
258	Mini-drill sped controller	Jul 81
259	Low-cost timer	Jan 82
260	CMOS flasher	Dec 79
261	Fog horn	Dec 79
262	Intercom	Dec 79
263	Egg timer	Dec 79
264	Siren	Mar 80
265	Mains appliance timer	Jul 83
266	Crystal set	Dec 79
267	Voltage multiplying crystal set	Dec 79
268	Nicad float charger	Mar 83

The curve for 'Typical charging characteristics of NiCad cells' (on page 31) is for one particular type and may not be indicative of most currently on the market. While the shape is generally similar, the maximum terminal voltage reached is generally between 1.4 V and 1.5 V, not 1.7 V as shown.

270	Solar-powered radio	Dec 79
271	Solar intensity meter	Dec 79
272	LED amp output indicator	Nov 83
273	Let caller for tennis	Jan 84
274	Fast Nicad charger	Feb 84

Figure 2 shows the battery negative connected to the heatsink. It should be insulated from it. The BYX/200L diode cathode connects to the collector of Q4/Q5 and R1/LED via the heatsink, not the wires shown.

275	Bathroom heater timer	Jun 84
277	Ready-set-go timer	Oct 84
278	Door minder	Nov 84

The overlay and wiring diagram on page 70 contains an error in the caption at the top left corner. The sentence "makes sure the green (neutral) mains lead is the longest" should read as follows: "make sure the green/yellow striped earth wire is the longest."

279	Darkroom exposure meter	Jan 85
280	Low battery voltage indicator	Mar 85
281	Power supply	Dec 86
282	Telephone screamer	Sep 86
283	Lotto selector	Dec 86
284	VCR Alarm	Nov 86
285	Oscillators and Ampfilers	Mar 87
286	Mutt Minder	Apr 87
287	LED Light Chaser	Oct 87

Two links left off overlay diagram, see December 87, p20.

288	Ring Tone Customizer	Jun 87

The pc board artwork is the wrong way around and also the wrong size. Write to ETI for a correct version.

289	Watch Alarm in coke tin	Dec 87
290	Baby sitter	Apr 88
291	Telephone intercom	Feb 88
294	Shock car alarm	Mar 88

TEST EQUIPMENT

101	Logic power supply	Jun 71
102	Audio signal gen	Jun 71
103	Logic probe	Jul 71
104	Soldering iron control	Aug 71
105	Dual power supply	Nov 71
106	CRO callbrator	Feb 72
107	Voltmeter	Feb 72
108	Decade resistance box	Sep 72
109	Digital frequency meter	Sep 72
110	FET voltmeter	Oct 72
111	IC power supply	Nov 72
112	Audio attenuator	Mar 73
113	Thermocouple meter	Sep 73
114	Dual beam adaptor	Jul 74
115	Linear IC tester	Aug 74
116	Impedance meter	Mar 75
117	Digital voltmeter	Aug 75
118	Frequency meter	Sep 75
119	Switching regulator	Dec 75
120	Logic probe	Sep 75
121	Logic pulsar	Sep 75
122	Logic tester	Oct 75
123	CMOS tester	Nov 75
124	Tone burst gen	Nov 75
125	Oscillator	Jun 75
126	rf power control	Jan 75
127	TTL super test	Feb 75
128	Audio mV meter	Jan 76
129	rf signal generator	Jan 76
130	Temp meter	Feb 76

The photo on page 45 is not that of the temperature meter. The correct photo may be found on page 55.

131	Power supply	Apr 76

Several references are made throughout the text to R14 and R15. Wherever R14 appears read R12, and wherever R15 appears read R13. In the How It Works section wherever R7 appears read R5.

132	Power supply	Feb 77
133	Phase meter	Apr 77
134	RMS voltmeter	Aug 77
135	Intersil panel meter	Oct 77
136	Linear scale panel meter	Mar 78
137	Audio oscillator	May 78
128	Audio wattmeter	Nov 78
139	SWR meter	May 78
140	1 GHz frequency counter	Mar/Apr 78
141	Logic trigger	Jan 79
142	Power supply	Feb 79

The wrong gauge wire was shown for coil L2. The correct gauge is 1.6 mm.
The circuit and wiring diagrams for this project contain a mistake that all builders should be aware of — even at this late stage. Wires from the transformer T1 (PF4244 240V/32V 300 VA) are incorrectly labelled orange and white on the circuit. They should be transposed so that 'orange' should connect to the rectifier rather than 'white' as is shown, and 'white' should connect to the circuit board instead of 'orange'.

143	Curve tracer	Jan 79
144	True RMS voltmeter	Jun 79
145	Test board	Jul 82
146	Mains master	Nov 79
147	Electronic load	Oct 80
148	Logic probe	Jul 79

Some readers have reported trouble with this project, apparently caused by the large spread in parameters of some 4049 ICs. Try chips of a different manufacture, is the advice we have received. Also, buffered 4049s or even 4009s may be used, but to get correct operation over the range of supply voltage from 5V to 15V, resistors R2 and R3 should be changed to a value of 1M each.

149	Two tone tester	Jul 80
150	Frequency meter	Dec 79
151	Ohm meter	Jan 80

If you find your speed potentiometer has a considerable 'dead band' at the 'top' (towards full speed) end, this indicates your drill has lower back-emf than that designed for. The cure is to increase R3. If all the speed control is crowded over about 60 of rotation, increase R3 to 330k. If you get 90 or 100 of rotation for zero to full speed, change R3 to 220k or 180k, etc. You may need to increase R4 from 27k to 56k or 68k, also. DISCONNECT THE UNIT FROM THE MAINS BEFORE MAKING ANY MODIFICATIONS.

152	Capacitance meter	Feb 80

The instrument will not function properly on the 1μ/ x 10 scale (i.e. 10μ full scale) as the integration time is not long enough. A simple modification cures this. Change SW3 to a DPST type. Change R1 to 1M2, Add a 100 ohm resistor switched across R7 by the extra pole of SW3.

153	Temperature probe	Jun 83

No.	Name	Date
	Note at the end of the parts list says that a 5V6, 1 W zener can be substituted for the original. This should actually read 5V1, 1 W.	
154	Digital logic pulsar	Jul 81
155	4/8/16 ohm audio dummy load	Jun 81
156	100 MHz hi impedance probe	Jun 81
157	Crystal marker	Oct 81
158	Low ohm meter	Nov 81
159	10-15 V expanded scale meter	Dec 81
	On page 37, the text mentions Project ETI-316, where we mean the ETI-326, published in the September '80 issue.	
160	13.8 V/10 A power supply	Jul 82
161	Digital panel meter	Aug 82
162	30 V/1 A power supply	Dec 82
	Mod for 162	Jun 84
163	40 V/5 A power supply	May/Jun 83
164	Zener tester	May 83
165	Tacho calibrator	Nov 82
166	Function generator	Jul/Aug/ Sept/Oct 83
	The following errors crept into the parts list; C17 should be deleted, C18 — 22p ceramic, C19 — 470p ceramic, C19 — 470p ceramic, C20 — 4n7 greencap, C21 — 47n greencap, C22 — 470n greencap, C23 — 4μ7/16 V RBLL, C24 — 47μ/16 V RBLL. C24 shown on the circuit as 100n was not put on the pc board. It may be soldered on the copper side between pins 1 and 14 of IC4. There are two R40s on the overlay. the one next to R54 is actually R58. Some relays may not match the board and it will be necessary to drill extra holes and wire them in with links.	
168	Continuity tester	Sep 85
169	Low distortion oscillator	Oct/Nov 85
	Resistors R38-R49, are labelled incorrectly on the overlay. Also on the overlay, the pc board track from pin 2 IC3 is shown leading to pin 16 IC5. Rather it should lead to pin 15 IC5. To correct this, cut the track from pin 2 IC3 at pin 16 IC5, and attach fly wire between the cut track and pin 15 of IC5.	
170	CRO calibrator	Feb 85
	In order to make the attenuators conform to the front panel artwork, use the following resistor values: R = 220R, R18 = 330R, R22 = 22R, R23 = 33R, R29 = 220R, R30 = 330R, R34 = 22R, R35 = 33R.	
171	Arbitrary waveform generator	Feb 86
172	Bit pattern detector	Apr 86
173	Electro static hazard detector	Jun 86
174	Timebase standard	Jul 86
175	20 MHz DFM Q1 and Q2 do not exist	Sept/Oct 85
177	Analogue Frequency Meter	Jun 87
178	Analogue Capacitance Meter	Jul87
179	Analogue Breadboard	Aug 87
180	Solid State Voltmeter	Dec 87/ Feb 88
	Errata for 180	Mar 88
181	RS232 Breakout Box	Nov 87
182	Digital luxmeter	Mar 85
183	Op amp tester	Apr 85
	The battery polarity was shown reversed in the original circuit diagram. The correct polarity is shown herewith.	
184	In-Circuit IC tester	Aug 87
185	Versiply	Feb 88
186	Wide-range ac voltmeter	Mar/Apr 88
187	Protoboard	Jun 88
188	Pcb Exposure unit	Jul 88
AUTOMOTIVE		
301	Variwiper	May 71
302	Tacho/dwell	Jul 71
303	Brake light indicator	Oct 71
304	Light-operated switch	Nov 71
305	Car alarm	Jan 72
307	Headlight reminder	Oct 72 Oct 74
308	Turn indicator	Feb 73
309	Battery charger	Aug 73
310	Ignition timing light	Jun 74
311	Tacho — timing light	Sep 74
312	CDI	Dec 74 Jan 75
313	Car alarm	Nov 74
314	Auto amp	Feb 75
315	Solid state flasher	Feb 75
316	Transistor ignition	May 77
317	Tacho warning light	Jul 77
318	Tacho digital	Jul 78
319	Variwiper Mk2	Sep 78
320	Battery indicator	Apr 79
321	Fuel level warning	Jan 80
322	Over-rev alarm	Mar 80
323	Headlight delay	May 83
324	LED tacho	Aug 80
325	Auto probe	May 80
326	Expanded LED voltmeter	Sep 80
327	Hazard flasher	Oct 80
328	Oil temp meter	Jan 81
329	Expanded scale car ammeter	Feb 81
330	Car alarm	Jul 81
332	Engine stethoscope	Aug 81
333	Vehicle reversing alarm	Jan 82
334	Auto tester	Jan 83
335	Programmable wiper controller	Mar 83
336	Dwell meter	Aug 83
337	Auto car antenna driver	Sep 84
340	Car alarm	Apr 84
341	Electronic jumper leads	Aug 85
342	Pulse-shaped CDI	Feb/Mar 85
	The circuit diagram should have shown R8 as 220k not 220R.	
343	Optical car alarm switch	Sept/Oct 85
344	Bike alarm	May 88
345	Demister timer	Jun 86
AUDIO		
400	Speaker	Jun 75
401	FET 4 channel mixer	Sep 71
402	Simple channel sound	Apr/Aug 71
403	Guitar sound box	Apr 71
404	FM conversion unit	Apr 71
405	Magna ray 8-30	Jul 72 Aug 71
406	Single transistor radio	Dec 71
407	Bass booster	Dec 71
408	Reverb unit	Mar 72
409	TV sound	Mar 72
410	Super stereo	May 72
411	Small speakers	Aug 72
412	LED peak program meter	Oct 83
	The linking for dot/bar mode is shown incorrectly on the circuit and component overlay. For a dot mode display, link pins 9 and 11 (as per the photograph of the board); for the bar mode, link pin 9 to the positive supply.	
413	100 W guitar amp	Sept 75 Dec 72
414	Stage mixer	Feb/Mar 73 Mar/Apr 75
415	Quadraflex speakers	Jan 73
416	25 W amp	Jan/Jul 73
417	Over LED	Aug 73
418	Music synth	Oct
419	Preamp	Sept 73
420	4 channel amp	Jan/Feb 75 Sept 83
421	Low-cost stereo speaker system	May/Jun 74
	On the pc board overlay on page 86 the labels on the two capacitors are reversed — C1 is the 2 μF capacitor, C2 the 8μF capacitor. The values shown are in the correct position. The Parts List and circuit diagram are correct.	
422	50 W stereo	Oct 75
423	Add-on 4-channel amp	Apr 74

PROJECT INDEX

No.	Name	Date
424	Spring reverb	Sep 74
425	Integrated amp	Jun-Sep, Dec 72
426	Rumble filter	Oct 74
427	Graphic equalizer	Oct 74
428	Amplifier	Dec 74
429	Colour organ	Nov 74
430	Line amplifier	Mar 75
431	FM antenna	Apr 75
432	Ceramic preamp	Jun 75
433	Active crossover	Sep 75
434	Two tape facility	Oct 75
435	Crossover amplifier	Oct 75
436	Dynamic noise amplifier	Sep 75
437	Simple speaker	Nov 75
438	Audio level meter	Dec 75
439	3-way speakers	Dec 75
440	25 W amplifier	Jul 75
441	Noise generator	Jan 76
442	Masterplay stereo	Sep 84
443	Expander compresser	Apr 76
444	5 W amp	Jun 76

On page 44 in the spectification table the frequency response should be 4 HZ to 200 kHz within +1 and −3 dB.

445	Stereo preamp	Jul 76
446	Audio limiter	Aug 76

The integrated circuit IC1 should not be a Philips type as these versions of the IC have buffered outputs. These devices cannot therefore be connected to give a FET for use in the linear mode as required in the audio limiter.

447	Audio phaser	Sept 76

The integrated circuit IC9 should *not* be a Philips type. These have buffered outputs and therefore cannot be connected to obtain a FET as required in the Audio Phaser.
On the circuit diagram RV1 is shown connected between +9 volts and the junction of R5 and R6. On the printed circuit board it is connected between +9 volts and the zero-volt line. This variation in connection does not affect operation of the phaser.
The phaser is sensitive to supply-voltage variations especially when using small batteries. Use a large battery, or use a 12 volt battery to feed a 9 volt zener regulator via a 220 ohm resistor.

448	Disco mixer	Nov 76
449	Balanced mic	Nov 76
450	Bucket brigade	Dec 77
451	50 Hz/100 Hz hum filter	Jul 79
452	Guitar practice amp	Jan 80
453	Class B amp	Apr 80
454	Fuzz board	Apr 80
455	Loudspeaker protection unit	Mar 80

On page 41 there is a note on the circuit diagram that says "D1-D4 are 1N914; D5, D6 are 1N4004". This is incorrect; the parts list shows the correct types.

456	140 W amp	May 80

The power transformer . . ." In the parts list on page 35, D1-D10 and D11-D15 are listed incorrectly. D1-D10 are A14Ps and D11-D15 are 1N4004s as shown on the circuit diagram.

457	Scratch and rumble filter	Sept 80
458	Peak/average LED level meter	Jun 81
459	Third octave graphic equalizer	Nov 82

In the circuit diagram on page 32, power supply section, diodes D2 and D3 are shown back to front. The pc board overlay is correct. In the parts list, R5 and R6 are shown as 15k, but 10k on the circuit. 10k is the correct value, though not critical.

460	Third octave analyzer	Nov 82
461	Balanced input preamp	Dec 82
462	Headphone monitor/splitter	Apr 84
463	Master play 2-way speakers	Oct 84
464	IC audio amp	Jul 83
465	Loudhailer using the 464	Jul 83
466	300 W amp	Feb 80
467	Guitar/mic preamp for 466-4	Jul 80

Firstly, on the circuit (page 49) exchange R34 and R35. The 1k resistor should now be connected from pin 9 of IC2b to the common rail (earth, or 0 V). The capacitor across the presence control, a 4n7 marked 'C20', is actually C24. These three components are correctly marked on the overlay.
Next, on the overlay photo (page 50) IC1 and IC2 have been shown with the incorrect orientation. Pin 1 of IC1 is located diagonally opposite to where it it is shown on the overlay. It should be adjacent to R1. Similarly with IC2, pin 1 should be located adjacent to R23. The pc board copper side has them marked correctly.

No.	Name	Date

On the Parts List, R35 and C24 do not appear. Add a 270R resistor and a 4n7 greencap, respectively. Finally, in the second paragraph on page 50, the maximum output is quoted as ". . . 200 volts peak to peak . . ." In reality, it is a more modest 20 volts peak to peak. Kit and component suppliers have already been notified.

469	Drum machine (precision synth)	Apr 82

Diodes D1 to D6 were omitted from the Parts List on page 43. They are all 1N914s or 1N4148s.

470	60 W amp	May 79

The earth rail onto the amplifier must be returned to the 0 volt connection on the power supply. Although it is obvious to most people it was not indicated on the circuit for the 470 module, but was shown on the wiring diagram for the Series 4000 amplifier system in the June issue.

471	Pre-amp	Jun 79

The loudness control produces 8 dB boost at 150 Hz and 10 kHz, rather than at 15 kHz and 10 kHz as the article stated (gremlins again . . .). Also in the circuit diagram the function LEDs are shown the wrong way round with respect to the switch, as in the LED power supply with respect to the overlay. The overlay is correct and should be followed, but either connection will work. In the parts list the resistors R118 and R119 have been omitted. They are both 15k, ½ W, 5%.

472	Power supply	Jul 80
473	Moving coil amp	Oct 80
474	4000 power amp interface	Feb 80
475	AM tuner	Aug 80

RFC1 was omitted from the parts list. This is a Phillips type VK200 wideband choke and consists of a six-hole ferrite bead (type number 4312-020-31550) with a length of 22 swg tinned copper wire passed through it five times. In the antenna details the copy beneath the antenna matching coil on page 26 should read: "For use with small loops 6-8 turns" and "For use with large loops 2 turns".

476	Series 3000 amp 'compact'	Nov 80

An error appears in the How It Works on page 28. Under the sub-heading "Power Amplifier" third paragraph, there is a sentence which reads: "This leaves a total of 0.6V to be dropped across the two 27 ohm resistors R27 and R28". It should read ". . . 100 ohm resistors R27 and R28".
On the overlay (in both Nov. & Dec.) R34 is shown as 270R when it should be 180R. In the parts list, R25, 26, 125 and 126 should be shown as 180R. Only R34 should be shown as "180R, see text". Capacitor C21 (same as C20) was left off the parts list.

477	Series 5000 power module	Jan/Feb/ Mar 81

In the circuit diagram capacitors C7 and C8 were shown connected between the gates of Q9 and Q11 respectively, and the feedback line. In fact, they connect between the gate and source of each device, as shown in the Feb. issue.
In the **February** issue, under How It Works, there is a typographical error in the second last sentence, third column. It reads 'Transistors Q4 and Q5 therefore form the main voltage gain section of the amplifier . . .". It should read "Transistors Q6 and Q8 . . .".
The ETI-477 MOSFET amp is not unstable if you build it the way we described. However, some readers have reported difficulties with the amplifier going into high frequency oscillation. There are two reasons for this. If capacitor C9 has a high self-inductance the amplifier output will be unloaded at high frequencies and oscillation will result. We found 'Elna' 630 V greencaps have a low inductance and the amp is not unstable using them.
Secondly, if resistors R25 and R27 have more self-inductance than the 'Noble' types we used, then the output stage may be unstable. There are two cures for this one. Either replace R25 and R27 with Noble types or connect a 47n greencap between the sources of Q9 and Q11. This is best done on the copper side of the board, mounting the capacitor between the two pads where the leads of each resistor go to the sources of Q9 and Q11.

478	Series 5000 Stereo preamp	Jul/Sept/ Oct 81

Overlay p38, Oct 81, shows R53 as 220R. It should be 220k.
The 400 Hz oscillator set-up procedures is as follows, not as per page 12 in Dec. '81. Take your multimeter, set to read ac volts, and connect it to one of the output sockets. Set the TAPE switch to OSC, and adjust RV4 to obtain 1.2 Vac (RMS) on the meter.

479	Series 5000 power amp adaptor	Mar 82
480	50/100 W amp	Dec 76
481	12 V 100 W amp	Jun 77
482	50 W stereo amp	Jan/Feb 77
483	Sound level meter	Feb 78
484	dBX	Jul 77
485	New equalizer with gyrator	Jun 77
486	Frequency shifter	Nov 77
487	Real-time audio analyzer	Feb 78
488	650 W 2-NDFL module	Jan 83
489	Mk2 real-time analyzer	Apr 78
490	Speech compressor	Dec 78
491	Graphic equalizer	Mar 79

A very important resistor was left off the circuit and overlay in this project — A 15.7 k resistor, made from an 18k and 120k in parallel, connects between the output of the gain pot and the input (pin 2) of IC6. The circuit will not work without it.

492	Sound bender	Feb 82
494	Loudspeaker protector	Oct 82

No.	Name	Date
495	TL speakers	Aug 77
496	4-way 4000/1 speakers	Feb 80
497	3-way 4000/2 speakers	Jun 80
498	PA system using the 499	Jun 82
499	MOSFET amp	Mar 82

Some people have had trouble with the output offset voltage adjustment, being unable to reduce it to 10 mV or less. This can be fixed by changing R2 from 100k to 33k. The input high-pass pole only rises to just under 20 Hz, which is OK.

1401	DI box	Sep 85
1402	Sampler	Apr/May/ Jun 86

Resistors mentioned in the Parts List as 5% should be 2% and those marked as 2% should be 5%. The standby power supply VA mentioned at the end of the How It Works should be in house style reading V_{GG} as in the circuit diagram. On the wiring diagram, the trigger switch is labelled incorrectly: terminal lettering F should read J and vice versa.

1402b	Digital Sampler Expansion	Apr 88
1404	4/channel mixer	Jul 85
1405	Stereo enhancer	Mar 85

It is necessary to buffer the metering circuitry from the main signal path. It was originally intended to put the buffers on the meter board but due to layout requirements it was decided that the main board was better. Unfortunately in the melee the buffers were deleted from the meter board but never reinstated on the main board. To fix this, an op-amp will have to be inserted between the main board and the meter board. The circuit and board are shown on p80, Apr '86. The small board mounts on two of the meter board mounting bolts on the right hand side (looking from the front). The positive supply and earth to the buffer can be taken from the meter board supply pins. The negative supply can be taken from the junction of C4 and IC2. The values of the two caps on the reverse side of the meter board should be dropped from 220n to 22n.

Also, the pin numbers from IC5 and the component numbers for R4, R7 and C7, C10 were marked incorrectly on the circuit diagram. The overlay is correct.

1406	Parametric equalizer module	Aug 86
1407	dbNH noise reduction	Dec 86
1408	Scan Audio HiFi speakers	Feb 87
1409	Passive Radiator	Mar 87
1410	Bass guitar amp	Aug/Sept 84
1412	Stereo Loudspeaker switcher	Feb 87

The pc board artwork was incorrectly pinned showing component side rather than copper side. To rectify: reverse the negative of the artwork.

1413	Electronic Crossover	Jun 88
	Parts list errata for 1413	Jul 88
1414	Walkam Amp See page 10 May ETI 1987 for correct diagram featured on page 61.	Sept 8
1415	Vifa SA-80 speakers	Jun 88
1416	Chorus Unit	Jul 87
1417	Vifa SA-100 Speakers	Jul 88
1418	Expandable Audio Mixer	Aug/Sept/ Oct 88
1419	Bench amplifier	Sept 88
1420	Indoor paging amp system	Jul 84
1421	Input and tone cont preamp	May 84
1422	Budget column speakers	Dec 84
1423	Stereo encoder	Oct 88
1424	Versatile Guitar Preamp	Nov 87
1425	Guitar note extender	Aug 88
1426	Quarter wave speaker	Dec 88

MISCELLANEOUS

501	Soil moisture meter	Apr 71
502	Emergency flash	May 71
503	Intruder alarm	May/Jun 71
504	Fastest finger	Jul 71
505	HI-powered strobe	Aug 71
506	Infrared alarm	Sep 71
507	The farmer's problem	Sep 71
508	Fluoro light dimmer	Oct 71
509	50-day timer	Dec 71
510	Safety crossing	Jan 72
511	Battery savers	Feb 72
512	Photographic timer	Mar 72
513	Tape-slide synchronizer	Apr 72
514	Sound-operated flash	May 72, May 76
515	Slave flash	May 72
516	12 V fluorescent light	Nov 72
517	Electronic decision-maker	Jan 73
518	Door monitor	Apr 73
519	Nicad	Feb 74
520	Digital stopwatch	Oct 73
521	Digital clock	Jul 73, Mar 74
524	Laser	Dec 73
525	Drill speed controller	Oct 74
526	Print timer	Aug 74
527	Pushbutton dimmer	Nov 75
528	House alarm	Jan 75
529	Poker machine	May/Jun 75
530	Temp controller	Oct 74
531	Coin collector Mk1	Dec 74
532	Photo timer	Jun 75
533	3-digit display	Jul 75, Aug 76
534	Cal stopwatch	Jan 76
535	Swimming pool alarm	Nov 75
536	Low-cost digital clock	Jan 75
537	Low batt warning	Feb 75
538	Hornet power supply	Mar 75
539	Touch switch	Mar 76

Add to the parts list:
IC1 integrated circuit 4049 or 449 (CMOS) (do not use Philips ICs or the 4009).
It is recommended that a 2k2 half watt resistor be fitted between gate and cathode of the SCR.

540	Universal timer	May 76
541	Train controller Mk1	Jun 76
543	STD timer	Jul 76
544	Heart rate monitor	Sep 76

In the parts list on page 77, C1 should be 100 nF and C2 should be a one microfarad 35 volt electrolytic.
Due to the simplicity of this device adjustment of the sensitivity control is fairly critical. To use the instrument adjust the sensitivity control upwards only sufficient to obtain reliable triggering. A too-high setting will result in false triggering and hence a too-high heart-rate indication.
In the How It Works section on page 79 in the third column, seventh line, read IC2/2 *not* IC2/1.

546	Bio resistance	Mar 77
547	Bell extender (telephone)	Jun 77
548	High power strobe	May 77
549	Metal detector	May 77
550	AM digital dial	Aug 78
551	Chaser	Sep 78
552	LED pendant	Sep 78
553	Tape-slide synchronizer	Oct 78
555	Light activated tacho	Nov 78
556	Windspeed	Dec 78
557	Reaction timer	Feb 79

The Q and Q bar outputs of IC6 are transposed on the circuit diagram. IC4 is a 4018.

558	Masthead flasher	Feb 79
559	Cable tester	Mar 79
560	Mains cable seeker	May 80
561	Metal detector	Mar 80

The component overlay on page 33 shows R3 as a 1M resistor where it should be 100k.

562	Geiger counter	Apr 80
563	Fast Nicad charger	Jul 80

Constructors having difficulty obtaining the 1N5625 diodes specified for D6 and D7 in this project, note that Motorola type MR-856 diodes may be substituted.

564	Digital clock (large)	Aug 80

The pc artwork on page 137 is missing a track between pin 5 of IC2 and pin 11 of IC3. With this missing, the project will work but the clock will gain around four minutes a day as IC2 will divide by a little less than 3000.

565	Laser	Jul 80
566	Pipe and cable locator	Apr 80
567	Core balance relay	Apr 81

On page 38 is the pc board for the ETI-567 Core-Balance Relay. Just in case you hadn't noticed, look carefully and you'll see the writing on the potcore and the transformer is laterally reversed. The picture is shown correctly on page 12 of the May '81 issue.
That wasn't the only thing the wrong way round. The two red wires from T2 (L1) are shown incorrectly on the overlay, page 39. Transpose them for correct operation. The How It Works is correct, but the dot on the top wire of L1 on the circuit should go on the lower wire.

No.	Name	Date

A reader has drawn to our attention a problem he experienced when using the core-balance relay with a long lead plugged into its output where a number of fluorescent lights were operating nearby. The core-balance relay would not trip on test with loads over about 25 watts. On investigation, he found severe RF noise, generated by the fluorescent lights, was preventing the unit's trip circuit from functioning. Looking at each end of L3 (secondary of T2, the sense transformer (using an oscilloscope, he found high amplitude noise on each, but of markedly differing amplitudes. The cure is simple — a 4n7 capacitor connected directly across L3. The unit still functions as designed, even with highly inductive loads plugged into the output. Our thanks to Bill Waters for passing that on.

568	Sound and light operated flash	Oct 80
569	Solar generator	Dec 87
570	Infrared 'trip' relay	Jan 82
572	ph meter	Dec 80
573	Process timer	Oct 79
574	Disco strobe	Sep 79
575	Fluoro light wand	Aug 79
576	EMG (electromyagram) monitor	Sep/Oct 79
577	Moving coil power supply	Oct 79
578	Simple Nicad charger	Jun 80

R2 should be shown as a 1W resistor.

581	15 V power supply	Jun 77
582	House alarm Mk3	Jul/Aug 77
583	Gas detector	Aug 77
585	Ultrasonic beam switch	Sep 77
586	Shutter timer	Oct 77
587	UFO detector	May 78
588	Dimmer	Nov/Dec 77, Jan 78
589	Temp meter	Dec 77
590	6-digit LCD stopwatch	Oct 78
591	4-digit up/down counter	Jul 78
592	3-channel light dimmer	Aug 78
593	Colour sequencer	Dec 78
594	Development timer	Apr 79
595	Aquarium light timer	May 79
596	White noise generator	Nov 81
597	Emergency light unit	Dec 80
598	Sequential touch switch	Feb 81
599	Infrared remote controller	Apr 81
1500	Metal detector	Dec 80, Apr 81

There are a number of designation errors on the circuit on page 42. Firstly, terminals T and V, which go to the volume pot RV5, are shown the wrong way round on both the circuit and wiring diagram. Transpose them and the pot will work in the correct manner. Secondly, the pin numbers to IC2a are shown incorrectly. The gate is actually pin 6 (not pin 3). The drain and substrate are connected (internally) to pin 14 which goes to +10 V. The source is pin 13 (not pin 1). Pins 1 and 2 of IC2 are unused. Pin 3 goes to 0 V. The overlay is correct.
It appears that C20 is shown on the overlay with incorrect polarity, the capacitor's construction and location of the + sign make this a bit confusing. The negative side connects to terminal R. Resistor R33 is shown as 10k on the circuit diagram. It should be 100k. The overlay and parts list are correct.
Search head wiring should be as follows: receive coils, red and black (resistance, about 50 ohms). These go to pins j and k on the pc board, via the DIN plug and socket. the cable shield and white wire are connected to the transmit coil (resistance about 12 ohms). The shield goes to 0 V at pin i and the white wire to pin h. Any extra wires in the head cable are unused.

1501	Negative ion generator	Apr 81
1502	Sling psychrometer	Dec 83
1503	Standby battery charger	Aug 81
1505	Emergency fluoro light unit	Aug 82
1506	Bicycle flasher (xenon)	Jul 82
1507	Lightbulb saver	Nov 85
1508	Model train controller	Dec 82, Dec 83
1509	Universal dc-dc inverter	Sep 82
1510	Model train controller	Jan 83
1511	Zero crossing temp controller	Feb 83
1512	Electric fence tester	Feb 83
1513	Digital frequency doubler	Jan 86
1514	Solid state relays	Nov 83
1515	Drill speed controller	Apr 83
1516	Model engine ignition	Jun 83

The Parts List on page 74 shows R16 as 18k, but the circuit diagram gives it as 560R. The cir-'cuit diagram is correct.

1517	Video distributor board	Sep 83

There are two errors in the wiring diagram of the Video Distributor Amp. On page 148, the two yellow wires from the 2851 transformer are shown going to the top and bottom tags of the tagstrip — this is incorrect. They should both be moved one tag toward the centre of the tagstrip.

1518	Video enhancer	Dec 83
1520	Wide band amp	Jul 83

Capacitors C6 and C8 are shown on the overlay on page 74 as 2p2 while the Parts List and circuit shows C6 as 3p3 and C8 as 10p. The latter values are correct.

1521	Digital exposure meter	Mar 84
1522	Multiple light controller	Mar/Apr 84
1523	Electronic scales	Jun/Jul 84
1524	Electronic mousetrap	Aug 84
1525	Motion Detector	Jun 87
1526	Fibre optic link	Apr 85
1527	Burglar alarm module	May/Jun 85
1528	Door controller	Jul 85
1530	Noise detector	Feb 86
1531	Brown out protector	May 86
1532	Iron temp controller	Sept 86

The circuit diagram is incorrect. The node of D2 and D4 joins the top of R11. There is no connection between R11 and the bezel or R9. The overlay is correct.

1533	300 W power supply	Nov/Dec 86
1534	Speedometer module	Jul/Aug 88
1535	Motion detector	Jun 87
1537	Phone recorder	Dec 88
1541	Sound Trigger	Nov 88

MUSIC

601	Music sync	Oct 83
602	Mini organ	Aug 76
603	Sequencer Mk1	Aug 77
604	Metronome	Sep 77
605	Lin-exp converter	Sep 78
606	Tuning fork	Nov 79
607	Sound effects unit — Steam Whistle	Aug/Sep 81 Mar 82
608	MIDI Patch Change	May 87
609	MIDI thru box	Mar 86
610	Drum synth module	Oct 74
611	MIDI matrix	Sep 86

All output ports are incorrectly labelled with pins 4 and 5 transposed. All pin 4s are commoned together and pulled up via R21. Pin 5 is connected to the output buffers.

612	Audio Test Set	Aug 87
613	MIDI Interface for C64	Nov 87

D99, cols 1 and 2 pin 21 not 20. Col 2 first para IC3 not IC1.

614	Patch Bay	Mar 88
615	Midi Switch	Nov/Dec 88

COMPUTERS

No.	Name	Date
630	HEX display	Dec 76
631	ASCII keyboard	Dec 76, Apr 77
632	VDU	Jan/Feb/ Mar 77
633	Video sync	Jan 77
634	8080 EDU INTERFACE	July 78
635	Micro power supply	Sep 77
636	S100 mother board	May 80
637	Cassette interface	Jan 78
638	2708 EPROM programmer	Jul 78
639	Doorbell	Mar 78
640	VDU Mk2 S100	Apr/May Jun 78
641	Philips printer interface S100	Sep 78
642	RAM card 16K	Feb 79

The inputs to IC38c on the circuit diagram should come from the BLOCK 1 to 4 lines rather than the CS 0 to 3 lines as shown. Two IC43s were accidentally shown. The lower of the two is the real IC43. The IC above and to the left of this is IC44, a 74LS154. In the list of ICs at the top of the diagram, IC45 should be shown as 74LS175.

643	S100 EPROM programmer	Dec 79
644	Modem	Oct 82,
644	Follow-up	Nov 83,
644a	Modification	Feb 84

No.	Name	Date

Note that R93 should be rated at 1 W or 1.6 W (e.g: Philips PR37 resistor). Capacitor C5 (in reference channel flip-flop, IC5) can be reduced to 680p to provide a better variation range for RV1 ('adjust output symmetry pot') Also note that C18 connects to pin 3 of IC12a on the pc board, not pin 2 as shown in the circuit. R48 goes to 0 V, not −6 V.
In the Parts List, transistors Q4, 6, 8 and 10 were cut off — they are all BC549s. C4 is shown as 1n, but 1n2 on the circuit — it can be either. C19 should be a 2n2 and a C21 a 330p. R48 should be 6k8, not 68k. Resistors R53 to R64 are given as 10k in the Parts List and 47k on the circuit. Either is correct. Note that the programming diodes were not mentioned in the Parts List. A total of 85 are required.
Experience has shown there can be wide variation in the characteristics of the 4528. IC4. At the extreme, it is found that RV1 (ADJUST OUTPUT SYMMETRY pot) does not have enough range. There are two cures for this: Capacitor C5 can be reduced to 680p or you can swap R2 and R16.
If 75 baud operation proves 'touchy' increase the value of C18 to 220n or greater.
There are discrepancies between the circuit diagram and the pc board. C18 goes to pin 3 of IC12a, not pin 2 as shown on the circuit diagram. Secondly, the junction of C31 and R76 goes to the junction of D14 and D4, not to pin 6 of IC20.
Experience indicates an improvement in performance under weak signal conditions can be obtained by making the pc board conform to the circuit here (output of IC20). This requires simply cutting one track and adding a link as shown in the accompanying diagram.

645	Tasman Turtle robot	Apr/May/ June 82
646	Turtle hand controller	Jul 82
647	Turtle-talk voice synthesizer	Sep/Oct 82
648	Micro-grasp robot arm	Apr/May 82
649	Light pen for Microbee	Aug 83
650	Stac timer	Nov 78
651	Binary HEX trainer	Jun 79
652	System 80 joystick interface	Aug 82
653	16-channel driver	Nov 82
654	Apple II card	Mar 83
658	RS232 breakout box	Dec 83
659	Vic20 audio cassette interface	May 84
660	1802 learner's microcompfuer	May/Jun/ Oct/Nov 81

In the circuit diagram on page 37 the data buss lines adjacent to pins 26 to 33 of IC5 are in reverse order; D0 goes to pin 26, D7 to pin 33. This reverses the data out signals from the 6821, but it's all taken care of, so do not worry, my little chickens. Note that, on page 38, the circuit shows the 1864 as IC3 when we all know damn well that it's actually IC4.
On overlay drawings numbers 4 and 5, pages 31 and 32, IC20 is shown as a type 74LS00. It should be 7475. Also, on overlay drawing 5, p.32, the link near IC8 is shown as LINK 2 when it should be LINK 3. On the circuit, pages 36-37, the designations for diodes D5 and D6 are reversed. The upper diode is D6. The note relating to D5, D6 is correct.

661	Chord tutor adaptor for 660	Nov 84
662	6802 processor board	Apr 84

Location 61C5 should be 86, not 96. On the circuit diagram for this project, page 74, the pushbuttons are labelled incorrectly. The correct positioning is detailed in ETI June '85, p8. Other minor corrections are: pin 20 of the 24-pin DIL plus is the PA7 connection. PB4 is on pin 9, not 15 as shown. IC1, pin 1, should be pulled down to ground.

664	Hobbybot robot	Nov/Dec 85
665	Computing routing switch	Oct 85
666	Printer switch	Feb 85
667	Printer sharer	Apr 85

The input connection attached to pin 6 of IC2c should be labelled STROBE-bar. The corresponding Centronics connector pin number should also be 1, not 10, while the Centronics pin number for the BSY output line should be 11 not 1.
If the Chatterbox is to be used with a VZ200 computer, capacitor C1 should be reduced to 100p to allow the circuit to trigger reliably from the narrower stobe pulse. Note also that the BASIC interpreter normally sends a CR-LF combination to the printer when returning to READY after running a program. This causes the Chatterbox to produce a continuous sound, even if your program leaves it silent. The solution is to end your program with a dead loop line (eg 1000 GOTO 1000), and break it using the CTRL + BREAK keys.

668	EPROM burner for Microbee	Feb 83

Two connections to the 4PDT switch have been interchanged. Looking at the wiring diagram on page 70, the two upper and lower right hand wires have been transposed, the upper one says "PIN 7 PERSONALITY SKT" but should go to R14/15 — SW2b, the lower one says "R14/15 — SW2b" and should go to pin 7 of the personality socket.

	Upgrade for 668	Sep 88
	Errata for 668 upgrade The upgrade for the EPROM burner refers incorrectly to the 688, it should be the 668	Nov 88
669	EPROM eraser	Jun 84
670	ASCII keyboard	May 82
671	'Bee parallel printer interface	Oct 83
672	'Bee teletype printer interface	Oct 83
673	'Bee multiprom board	Nov 83
674	'Bee joystick controller	Dec 83
675	'Bee serial-parallel interface	Jan 84
676	'Bee RS232 adaptor	Feb 84

The pinout for the transistors, shown on page 65, is all screwed up. Use the pinout on page 111.

No.	Name	Date
677	Chatterbox voice synthesizer	Jan 85
678	'Bee ROM reader	Apr 84
679	'Bee joystick adaptor	Jun 85
680	280 cpu board	No 79
681	Prog character generator	Jun 80

In Table 1 on page 69, the heading at the top of the left hand column should read "Value of Rp" as the values of RV1 and RV2 are fixed at 5k. On page 70, IC27 has a pin at the bottom marked "18" when it should be 15 — it's only a 16-pin chip, anyway! On page 73, in the parts list, R3 is listed as 1k9, 2%. A 1k8, 5% resistor is OK here. On page 74, under "Dipswitch No. 2:", second paragraph, the lines "We recommend that you put the joystick port at hex 'FF' . . . should say . . . put the joystick port at hex 'EF' . . ." The joystick setup procedure is correct as it places the joysticks at EF.
In addition, a number of typographical errors appeared on the circuit diagram on page 70. Address lines A11, A13 and A14 were shown as going to pins 27, 35 and 36 respectively. This is incorrect. A11 goes to pin 87, A13 to pin 85 and A14 to pin 86.

682	S100 prom board	Mar 81
683	Computer controller	Dec 84
684	Intelligent modem	Dec 85, Feb/Mar 86/ Jun 86/Jul 86/ Aug 86
685	2650 100 computer	Dec 81

In the parts list, the power supply input bypass tantalum capacitors were erroneously specified as 6 V types. They should be 35 V types — these are capacitors C2, C4 and C5. Also capacitors C8 and C9 may be 6 V or 10 V tantalums, but capacitors C6 and C7 should be 15V or 25 V types.

686	PPI EPROM programmer	Oct 82

In the power supply circuit at the bottom of page 72 the A-E-N on the 240 Vac input should be A-N-E. Q1 is missing from the Parts List. It is a BC547.

687	VZ-200 update Transpose pin 4 and 5 of IC1	Jul 86
688	Bipolar PROM programmer	Jun 83

At date of going to press with this project, Chuck Simmers had only tried the National bipolar PROMs so check the specifications before attempting to program other makes using this project.

689	Bus sharing switch D3 on the overlay should be ZD1	Jan 86
690	Little big board	Oct/Nov 83
692	RS-232 to 29 mA current loop	Jan 85
693	Tape auto search	Jun 85
694	FORTH computer	May 85
695	VZ-200 terminal	Aug 85
696	RSC-FORTH card extension	Dec 85
697	FORTH controller board	Mar 86
698	Auto-dialler for modem	Jul 85
699	300 baud modem	May 85
1601	RS232 for Commodore	Jul 86
1602	Commodore function switches	Aug 86
1603	Commodore tape duplicator	Oct 86
1604	Twin joystick for 'Bee	Aug 86
1605	FORTH A-D card	Sep 86
1606	RIE 'Bee extender	Nov 86
1607	Commodore talker	May 87
1608	RS232 Switcher	Jul 87
1609	Apple Modem Card	Oct 87
1610	Speech Controller	Mar 88
1611	VZ300 EPROM programmer	May/Jun 88
1612	VZ300 Data logger	Jul 88
1613	Baby AT	Aug/Sep Oct 88
1614	PC Turbo board	Nov 88
1616	16-bit computer	Dec 86, Feb-Apr 87
1616	Basic	Jun 87
1617	Applix Disc Drive	Oct-Nov 87
1618	Modem P+1	Dec 88

RADIO FREQUENCY

701	Masthead amp	Dec 74
702	Radar alarm	May 75
703	Antenna matcher	Jun 75
704	Cross hatch generator	Aug 75
705	Three simple receivers	Dec 75
706	Marker generator	Feb 76

No.	Name	Date

The photo on page 55 is not that of the marker generator as stated. The correct photo can be found on page 45.

707	Converter for 28, 52 and 144 MHz	Feb 76
708	Active antenna	Mar 76
709	Attenuator	Mar 76
710	Power amp	Apr 76
711	Remote control switch	Jul/Aug/ Sep 76

MPF 121 transistors are no longer available. The MPF 131 may be used as a substitute as these are the same chip mounted in a slightly different package.

712	CB power supply	Jun 77
713	Add-on FM tuner	Sep 77
714	TV-FM antenna	Feb/Mar 78
715	2 and 6 m power amp	Nov 77
716	Power amp	Jan 78
717	Cross hatch marker	May 78
718	SW receiver	Oct 78
719	Field strength meter	Nov 78
720	2 m VFET power amp	Jan 79
721	Aircraft band converter	Mar 79
722	Project 721 antenna	May 79
723	Selective caller	Feb 82

The last two lines of the intro should read: ". . . then this simple accessory allows you to turn down the volume, notifying you when that 'certain party calls — no tones or funny noises required".

724	Microwave oven leak detector	Jul 79
725	Polyphase SSB generator	Aug 79
726	6 and 10 m power amp	Feb 79

The overlay was perhaps not as clear as it could have been in a few places. The coax cables, A and B, shown near the changeover relay, seem to have their shields connected to the RF output track beneath them. Actually, the lead going up to the comment 'shields earthed' indicates what to do with them. Strap them to the ground to the left of the relay, adjacent to the shim strap.
As the low frequency gain of the DX542CF, used in the ETI-726, is uncharacterised some amps may show HF instability. This problem is easily cured by damping RFC1 with a resistor, around 5 ohms in value, connected in parallel.
If you like to play it safe with regard to TV1, the filter described for use with ETI-715 6m amp, published on p.52 of the January 1978 issue of ETI, will serve very well.

727	Antenna matcher	Jan 81
728	UHF TV antenna	Mar 81

The text states the folded dipole was constructed of aluminium strips 3 mm thick by 12 mm wide, while the diagram on page 43 shows the width to be 25 mm. It is in fact 25 mm wide, but this dimension is not critical and either strip width will work.

729	UHF masthead amp	Apr 81
730	RTTY receiver converter	Aug 79

No.	Name	Date

All references to Q1 in the article should refer to Q2, BF338, as there is no way that the circuit will work as shown. If there are difficulties in obtaining the correct waveform at the output of IC7, it may be necessary to change the 56k resistors to 68k, and the 8k2 resistor to 10k. Also note that pin 1 and pin 16 of the CMOS hex inverter should go to + 12 V and pin 8 to 0 V.

731	RTTY modulator board	Sep 79

If the tone oscillator doesn't oscillate, try placing a 22n capacitor from the emitter of Q4 to common. Note that stability of the oscillator is greatly improved if you use silver mica or styroseal capacitors or C5, C6 and C7.

733	Microbee RTTY	Apr 83
734	Phone patch line interface	May 83
735	UHF to VHF TV converter	May 81
736	Picture plucker	Sep 83
737	70 cm preamp	May 84
738	UHF booster amp	Jul 84
739	AM stereo decoder	Oct 84
740	FM tuner	Feb/Mar 76

The LED spacing is 1.25 MHZ *not* 800 kHz. The display driver IC is a UAA 170 *not* a UA 170. The varicap stabiliser is a TAA 550 not a TA550.

741	10-channel synth radio mic	Dec 84/ Jan 85
742	Broadcast/coms speaker	Feb 85
743	25 W UHF power amp	Jun 85
744	UHF/VHF tuner	Apr 86
745	AM Radio	Mar 87
746	AM Transceiver	Apr/May 87
747	Baudot to Centronics converter	May 88
750	6 m amp	Dec 83
751	FM bug	Dec 85

What could go wrong with this one? A typo. The equation for the turns ratio in the How It Works section (p.50) should be:

$$N = k\sqrt{\frac{Ri}{Ro}}$$

755	RTTY transceiver	Nov/Dec 84
756	VZ200 RTTY transceiver	Nov/Dec 84

There are nine links on the decoder board, not eight. On the circuit diagram, P. 109, C23 should read 470n; Parts List is correct. P. 110 in the table under "Immediate Commands", the second command is SHIFT X. In the text on P. 110, second last paragraph, the last sentence should read: "See that the two polarized capacitors (C21 and C22) are correctly oriented." Note that R7 is actually 2k7, as per Parts List, not 4k7, as per circuit.

757	Cat RTTY/FAX	Nov/Dec 85
760	Video RF modulator	Oct 81
764	AM Transceiver Part 2	May 87
780	Novice tx	May/Jun 76

ELECTRONICS

Programmes

```
00100 REM Computer Cricket
00110 REM S.L. Robjohns Feb 1988
00120 DIM B(2),N(2),E(2),T(2),O(2),W(2),JO(2),K(2),TO(2),T2(2),T3(2)
00130 DIM HO(2,11),AO(2,11),A1(2,11),BO(2,7),B1(2,7),SO(2,7),S1(2,7)
00140 DIM P(2,11),U(2,7),V(2,7),B4(2,7)
00150 STRS(2000)
00160 REM ## Team Data ##
00170 JO$(1)="FIRST":JO$(2)="SECOND":C=1
00180 GOSUB1540
00190 CURS7,4:PRINT"Is the "¦JO$(C)¦" team data on disk (Y or N) ?  ";
00200 Q1$=KEY$:IFQ1$=""THEN200ELSEIFQ1$()"Y"ANDQ1$()"y"THEN270
00210 REM # Recalling Team Data From Disk #
00220 CURS7,7:INPUT"Enter filename on disk 'NAME.EXT' :  "¦F2$
00230 CLOSE 6:OPEN "I",6,F2$:IN#6 ON:OUT#0:OUT#0 OFF:INPUTTO$(C),B(C),K(C)
00240 FORZ=1TO11:INPUTHO$(C,Z),AO(C,Z):NEXTZ
00250 FORZ=1TOB(C):INPUTBO$(C,Z),B1$(C,Z),SO(C,Z):NEXTZ
00260 IN#0:OUT#0:CLOSE 6:IFC=1THENLETC=2:GOTO180ELSELETC=1:GOTO520
00270 REM  # Entering Team Data #
00280 GOSUB1540:GOSUB1550
00290 CURS13,4:PRINT"Enter the "¦JO$(C)¦::INPUT" team name :  "¦TO$(C)
00300 GOSUB1540:GOSUB1550
00310 PRINT"Enter team players in batting order 'NAME,BATTING AVE' :":PRINT
00320 FORZ=1TO11:PRINTTAB(20)¦[I3 Z]¦::INPUT".  "¦HO$(C,Z),AO(C,Z)
00330 IFLEN(HO$(C,Z))>9THENNEXT# Z 300ELSENEXTZ:PRINT\
00340 PRINTTAB(7)¦:INPUT"Enter the number assigned to the WICKET KEEPER : "¦K(C)
00350 GOSUB1540:GOSUB1550
00360 PRINT"Enter team bowlers in bowling order 'NAME,P/S,BOWLING AVE.' :"
00370 PRINTTAB(10)"('P' for pace bowler : 'S' for spin bowler)"
00380 PRINTTAB(10)¦"Maximum of 7 - Enter '0,0,0' when finished":PRINT
00390 FORZ=1TO7:PRINTTAB(20)¦[I3 Z]¦:INPUT".  "¦BO$(C,Z),B1$(C,Z),SO(C,Z)
00400 IFLEN(BO$(C,Z))>9THENNEXT# Z 350
00410 IFBO$(C,Z)="0"THENLETB(C)=Z-1:NEXT# Z 420ELSENEXTZ:B(C)=7
00420 CLS:CURS5,4:PRINT"Do you wish to save this team on disk (Y or N)?  "¦
00430 Q2$=KEY$:IFQ2$=""THEN430ELSEIFQ2$="y"ORQ2$="Y"THEN450
00440 IFC=1THENLETC=2:GOTO180ELSE520
00450 REM # Storing Team Data on Disk #
00460 CURS5,7:INPUT"Enter name of file to be saved 'NAME.EXT' :  "¦F2$
00470 CLOSE 6:OPEN "O",6,F2$:OUT#6:Q7$=CHR$(34)
00480 PRINTQ7$¦TO$(C)¦Q7$¦","¦B(C)¦","¦K(C)
00490 FORZ=1TO11:PRINTQ7$¦HO$(C,Z)¦Q7$¦","¦AO(C,Z):NEXTZ
00500 FORZ=1TOB(C):PRINTQ7$¦BO$(C,Z)¦Q7$¦","¦Q7$¦B1$(C,Z)¦Q7$¦","¦SO(C,Z):NEXTZ
00510 OUT#0:CLOSE 6:IFC=1THENLETC=2:GOTO180ELSELETC=1
00520 REM ## Toss ##
00530 CLS:UNDERLINE:CURS24,2:PRINT"TEST MATCH No."¦C:NORMAL
00540 L=INT(RND#2)+1:CO$=TO$(L):S=INT(RND#6):C=C+1
00550 IFL=1THENLETM=2ELSELETM=1
00560 IFS()0THEN570ELSELETA=L:L=M:M=A
00570 REM ## Match Begins ##
00580 CURS(41-LEN(CO$))/2,6:PRINT"## "¦CO$¦" has Won the Toss ##"
00590 IFS=0THENLETP4$="BOWL"ELSELETP4$="BAT"
00600 CURS22,8:PRINT"(and will "¦P4$¦" first)":PLAY 0,32:HIRES
00610 N=0:O3=0:F3=0:F4=0:T3(1)=0:T3(2)=0
00620 N=N+1:IFN=5THEN520
00630 G=1:H=1:I=1:J=2:F1=0:F5=0:B3=0:B2=FLT(B(M)):E1=((RND#4)+3)/100
00640 FORZ=1TO11:P(L,Z)=0:NEXTZ:FORZ=1TO7:U(M,Z)=0:V(M,Z)=0:B4(M,Z)=0:NEXTZ
00650 O(M)=0:T(L)=0:W(L)=0:E(L)=0:GOSUB1360
00660 IFN<3THENCURS1,16:PRINT"1st Innings"¦ELSECURS1,16:PRINT"2nd Innings"¦
00670 GOSUB1560:F1=F1+1:IFF1)1THEN760ELSEIFO3=0THENCURS1,1:PRINT"Day 1"
00680 IFO(M)=0THEN760ELSEIFN=1ANDO3)170ANDT3(L)>520THEN1270
00690 IFO3=300RO3=1230RO3=2160RO3=3090RO3=402THENLETT5$=" Lunch":GOTO750
00700 IFO3=610RO3=1540RO3=2470RO3=3400RO3=433THENLETT5$=" Tea":GOTO750
00710 IFO3=930RO3=1860RO3=2790RO3=372THENCURS6,1:PRINT" -  Stumps"ELSE730
00720 GOSUB1800:CURS4,1:PRINTINT(O3/94)+2:GOTO760
00730 IFO3<>465THEN760
00740 CURS6,1:PRINT" # Match Drawn":GOSUB1810:GOSUB1800:GOTO520
00750 CURS6,1:PRINT" - "¦T5$:GOSUB1800
00760 IFB4(M,G)<6THENCURS57,G+3:PRINT"0"
00770 IFV(M,G)=0THENCURS61,G+3:PRINT"0"
00780 IFU(M,G)=0THENCURS64,G+3:PRINT"0"¦
00790 REM # Nil Event #
00800 IFY=2THENLETB4(M,G)=B4(M,G)+1:B3=B3+1ELSE830
00810 IFB3=6THENGOSUB1290
00820 CURS60,16:PRINT[I4 O(M)]¦:GOTO670
00830 REM # Run Scored #
00840 IFY=1THENLETB4(M,G)=B4(M,G)+1:B3=B3+1:R=INT(RND#4)+1ELSE980
00850 V(M,G)=V(M,G)+R:CURS58,G+3:PRINT[I4 V(M,G)]
00860 T(L)=T(L)+R:E(L)=INT(FLT(T(L))#E1)
00870 IFN<3THENLETT2(L)=FLT(T(L)+E(L)):T3(L)=T2(L):GOTO890
00880 T3(L)=T2(L)+FLT(T(L)+E(L))
00890 CURS34,15:PRINT[I4 E(L)]:CURS34,16:PRINT[I4 T(L)+E(L)]¦
00900 P(L,I)=P(L,I)+R:CURS34,I+3:PRINT[I4 P(L,I)]
00910 IFR=2ORR=4THEN920ELSELETA=I:I=J:J=A
00920 IFB3=6THENGOSUB1290
00930 CURS60,16:PRINT[I4 O(M)]¦
00940 IFN<>2THEN950ELSEIFT3(L)>T3(M)+30OTHEN1270
00950 IFN<>3ORF3=1THEN970
00960 IFT3(L)-T3(M)>3.3#(465-O3)ANDO3<431THEN1270
00970 IFN=4ANDT3(L)>T3(M)THENLETF4=1:GOTO1070ELSE670
00980 REM # Wicket Falls #
00990 B5$=BO$(M,G):GOSUB1680:B4(M,G)=B4(M,G)+1:B3=B3+1:IFD1$="run out"THEN1010
01000 U(M,G)=U(M,G)+1:CURS62,G+3:PRINT[I3 U(M,G)]
01010 W(L)=W(L)+1:CURS20,16:PRINT[I4 W(L)]¦
01020 CURS11,I+3:PRINTD1$:CURS13,I+3:PRINTD3$
01030 CURS23,I+3:PRINTD2$:CURS25,I+3:PRINTB5$
01040 CURS38,I+3:PRINT[I4 T(L)+E(L)]
01050 IFW(L)<10THEN1240ELSECURS60,16:PRINT[I4 O(M)]¦:CURS11,J+3:PRINT"not out"
01060 REM ## Match Result ##
01070 IFF3=0THEN1090ELSEIFN=3THENCURS60,14:PRINT[I4 T(L)+E(L)]:GOTO1130
01080 CURS60,13:PRINT[I4 T(L)+E(L)]:GOTO1130
01090 IFN>2THENCURS60,10+N:PRINT[I4 T(L)+E(L)]¦:GOTO1130
01100 CURS55,12+N:PRINT[I4 T(L)+E(L)]
01110 IFN=2ANDT3(L)<=T3(M)-200THEN1120ELSE1130
01120 F3=1:CURS6,1:PRINT" # Follow On":GOSUB1800:GOTO620
01130 IFF4<>1THEN1150
01140 C1$=TO$(L):C4$=" Wkts":M1=FLT(10-W(L)):GOSUB1810:GOSUB1790:GOTO520
01150 IFF5=1THENGOSUB1800:GOTO1230
01160 IFN=4ANDT3(M)>T3(L)THEN1170ELSE1180
01170 C1$=TO$(M):C4$=" runs":M1=T3(M)-T3(L):GOSUB1790:GOTO520
01180 IFN=4ANDT3(L)=T3(M)THEN1190ELSE1200
01190 CURS6,1:PRINT" # Match Tied":GOSUB1810:GOSUB1800:GOTO520
01200 IFN=3ANDT3(L)<T3(M)THEN1210ELSE1220
01210 C1$=TO$(M):C4$=" & Inn":M1=T3(M)-T3(L):GOSUB1790:GOTO520
01220 CURS6,1:PRINT" - All Out":GOSUB1800
01230 IFL=1THENLETL=2:M=1:GOTO620ELSELETL=1:M=2:GOTO620
01240 I=I+1:IFI<=JTHEN1240ELSECURS37,I+3:PRINT"0"
01250 IFB3=6THENGOSUB1290
01260 CURS60,16:PRINT[I4 O(M)]¦:GOTO670
01270 CURS6,1:PRINT" # Declaration":F5=1:GOSUB1810:GOTO1070
01280 REM ## Bowler Selection ##
01290 B3=0:F1=0:O(M)=O(M)+1:O3=O3+1:H=G:G=INT(B4(M,G)/6):CURS54,G+3:PRINT[I4 G]
01300 IFO(M)>15THEN1320
01310 G=INT(RND#2)+1:IFG=HTHEN1310ELSE1350
01320 IFN>2ORO(M)>50ORB(M)<3THEN1340
01330 G=INT(RND#3)+1:IFG=HTHEN1330ELSE1350
01340 G=INT(RND#B2)+1:IFG=HTHEN1340
01350 A=I:I=J:J=A:H=G:RETURN
01360 REM ## Score Board ##
01370 IFN>1THEN1470ELSEPLOT 0,231TO510,231:PLOT 340,231TO340,1
01380 PLOT 340,87TO510,87:PLOT 340,23TO510,23
01390 CURS1,3:PRINT"BATSMAN":CURS17,3:PRINT"DISMISSAL":CURS35,3:PRINT"TOT"
01400 CURS39,3:PRINT"FOW":CURS45,3:PRINT"BOWLER"
01410 CURS56,3:PRINT"O":CURS60,3:PRINT"R":CURS64,3:PRINT"W"¦
01420 CURS45,12:PRINT"Innings":CURS56,12:PRINT"1st":CURS61,12:PRINT"2nd"
01430 CURS45,13:PRINTTO$(L):CURS45,14:PRINTTO$(M)
01440 CURS27,15:PRINT"Extras"
01450 CURS15,16:PRINT"TOTAL"¦:CURS24,16:PRINT" Wkts for"¦
01460 CURS45,16:PRINT"Toss "¦CO$(¦1,3)¦:CURS56,16:PRINT"Over"¦
01470 CURS34,15:PRINT"   O":CURS20,16:PRINT"   O"¦
01480 CURS34,16:PRINT"   O"¦:CURS60,16:PRINT"   O"¦:CURS20,1:PRINT[A45 32]
01490 CURS34-LEN(TO$(L)),1:PRINTTO$(L)¦"      versus      "¦TO$(M)
01500 FORZ=4TO14:CURS1,Z:PRINT[A41 32]:CURS1,Z:PRINTHO$(L,Z-3):NEXTZ
01510 FORZ=4TO10:CURS45,Z:PRINT[A20 32]:NEXTZ
01520 FORZ=4TOB(M)+3:CURS45,Z:PRINTBO$(M,Z-3):NEXTZ
01530 CURS37,4:PRINT"O":CURS37,5:PRINT"O":RETURN
01540 CLS:CURS23,1:UNDERLINE:PRINT"COMPUTER CRICKET":NORMAL:RETURN
01550 PRINTTAB(13)"(Initial Data - All NAMES max 9 char)":PRINT:RETURN
01560 REM ## Ball Result Selection ##
01570 IFO3>372THENLETA1(L,I)=0.9#AO(L,I)ELSELETA1(L,I)=AO(L,I)
01580 IFO3<=93ANDB1$(M,G)="S"THENLETV2=1.5:GOTO1600ELSE1590
01590 IFO3>372ANDB1$(M,G)="S"THENLETV2=0.85:GOTO1600ELSE1610
01600 S1(M,G)=V2#SO(M,G):GOTO1620
01610 S1(M,G)=SO(M,G)
01620 IFA1(L,I)>100THENLETA1(L,I)=100ELSEIFA1(L,I)<1THENLETA1(L,I)=1
01630 IFS1(M,G)<1THENLETS1(M,G)=1
01640 X=INT(RND#9600):IFX<INT(1100/S1(M,G))THENLETY=3:GOTO1670
01650 IFX>1100ANDX<INT(16#A1(L,I))+1100THENLETY=1:GOTO1670
01660 IFX>2700ANDX<INT(69#AO(L,I))+2700THENLETY=2ELSE1640
01670 RETURN
01680 REM ## Dismissal Selection ##
01690 D=INT(RND#100):IFD>96ANDB1$(M,G)="P"THEN1690ELSEIFD>34THEN1720
01700 F=INT(RND#11)+1:IFF=K(M)ORB5$=HO$(M,F)THEN1700
01710 D1$="c":D2$="b":D3$=HO$(M,F):GOTO1780
01720 IFD<52THENLETD1$="c":D2$="b":D3$=HO$(M,K(M)):GOTO1780
01730 IFD<55THENLETD1$="c & b":D2$="":D3$="":GOTO1780
01740 IFD<83THENLETD1$="":D2$="b":D3$="":GOTO1780
01750 IFD<93THENLETD1$="lbw":D2$="b":D3$="":GOTO1780
01760 IFD<97THENLETD1$="run out":D2$="":D3$="":B5$="":GOTO1780
01770 D1$="s":D2$="b":D3$=HO$(M,K(M))
01780 RETURN
01790 CURS1,1:PRINTC1$(¦1,3)¦" won by"¦INT(M1)¦C4$¦
01800 CURS896:INPUT""¦K1$:CURS6,1:PRINT[A14 32]:RETURN
01810 CURS11,I+3:PRINT"not out":CURS11,J+3:PRINT"not out":RETURN
```

Computer cricket

If you have ever pondered the relative merits of the better cricket teams of the past 100 years then here is your chance to see how they compare.

'Computer Cricket', written for the MicroBee, allows you to play Test Cricket matches between teams of your choice without interruptions due to rain, bad light, or streakers. The teams, together with the players' batting/bowling averages, are entered and if desired stored on disk for future matches.

Each test, taking 15 to 20 minutes to play, features declarations, follow-on and takes account of pitch age and players' relative ability to pro-

duce realistic games lasting between 3 and 5 days depending on the standard of the teams.

The program displays the scoreboard over by over as the game progresses, with the action pausing at session and innings breaks, and at the end of each match. Pressing the 'RETURN' key will continue play after a pause. The day, session and result of the game is displayed in the top left corner of the scoreboard.

All team and player names are limited to 9 letters and it is suggested that for the best display, the team names should be entered using upper case letters and the players' names using standard upper and lower case.

S. L. Robjohns,
Somerton Park,
SA.

```
                00100 ;       * * * * * * * * * * * * *
                00110 ;       * WORDBEE FILE COPIER *
                00120 ;       *  BY GARY R. LAMING  *
                00130 ;       *    FEBRUARY 1988    *
                00140 ;       * * * * * * * * * * * * *
F400            00150         ORG     0F400H
F400 3E0C       00160         LD      A,0CH
F402 CD2FA6     00170         CALL    0A62FH
F405 21F5F4     00180         LD      HL,TEXT1
F408 1100F2     00190         LD      DE,0F200H
F40B 012C00     00200         LD      BC,2CH
F40F EDB0       00210         LDIR
F410 210000     00220         LD      HL,0
F413 FD212EF2   00230         LD      IY,0F22EH
F417 0600       00240         LD      B,0
F419 CD0680     00250 READ    CALL    8006H
F41C FE08       00260         CP      8
F41E 2810       00270         JR      Z,BACKSP
F420 FE7F       00280         CP      7FH
F422 280C       00290         JR      Z,BACKSP
F424 FE0D       00300         CP      13
F426 2816       00310         JR      Z,CALCNO
F428 FD7700     00320         LD      (IY),A
F42B FD23       00330         INC     IY
F42D 04         00340         INC     B
F42E 18E9       00350         JR      READ
F430 78         00360 BACKSP  LD      A,B
F431 FE00       00370         CP      0
F433 28E4       00380         JR      Z,READ
F435 FD2B       00390         DEC     IY
F437 05         00400         DEC     B
F438 FD360020   00410         LD      (IY),32
F43C 18DB       00420         JR      READ
F43F FD2B       00430 CALCNO  DEC     IY
F440 110100     00440         LD      DE,1
F443 CD84F4     00450         CALL    DECML
F446 110A00     00460         LD      DE,10
F449 C484F4     00470         CALL    NZ,DECML
F44C 116400     00480         LD      DE,100
F44F C484F4     00490         CALL    NZ,DECML
F452 11E803     00500         LD      DE,1000
F455 C484F4     00510         CALL    NZ,DECML
F458 112710     00520         LD      DE,10000
F45B C484F4     00530         CALL    NZ,DECML
F45E 1122F2     00540 NEXTHL  LD      DE,0F222H
F461 E5         00550         PUSH    HL
F462 2B         00560         DEC     HL
F463 7C         00570         LD      A,H
F464 B5         00580         OR      L
F465 CCECF4     00590         CALL    Z,LAST
F468 C4ABF4     00600         CALL    NZ,COUNT
F46B 210109     00610         LD      HL,0901H
F46E 222105     00620         LD      (0521H),HL
F471 7E         00630         LD      A,(HL)
F472 23         00640         INC     HL
F473 CD75C9     00650         CALL    0C975H
F476 3E0C       00660         LD      A,0CH
F478 CD4580     00670         CALL    8045H


ADDR   CODE   LINE   LABEL  MNEM   OPERAND


F47B E1         00680         POP     HL
F47C 2B         00690         DEC     HL
F47D 7C         00700         LD      A,H
F47E B5         00710         OR      L
F47F 20DD       00720         JR      NZ,NEXTHL
F481 C30EC0     00730         JP      0C00EH
F484 FD7E00     00740 DECML   LD      A,(IY)
F487 E60F       00750         AND     0FH
F489 2804       00760 LOOP    JR      Z,DONE
F48B 19         00770         ADD     HL,DE
F48C 3D         00780         DEC     A
F48D 18FA       00790         JR      LOOP
F48F D9         00800 DONE    EXX
F490 2121F5     00810         LD      HL,TEXT2
F493 1100F2     00820         LD      DE,0F200H
F496 010700     00830         LD      BC,7
F499 EDB0       00840         LDIR
F49B 2128F5     00850         LD      HL,TEXT3
F49E 1117F2     00860         LD      DE,0F217H
F4A1 011500     00870         LD      BC,15H
F4A4 EDB0       00880         LDIR
F4A6 D9         00890         EXX
F4A7 FD2B       00900         DEC     IY
F4A9 05         00910         DEC     B
F4AA C9         00920         RET
F4AB AF         00930 COUNT   XOR     A
F4AC 3242F5     00940         LD      (PRINT0),A
F4AF 011027     00950         LD      BC,10000
F4B2 CDCEF4     00960         CALL    DECIM
F4B5 01E803     00970         LD      BC,1000
F4B8 CDCEF4     00980         CALL    DECIM
F4BB 016400     00990         LD      BC,100
F4BE CDCEF4     01000         CALL    DECIM
F4C1 010A00     01010         LD      BC,10
F4C4 CDCEF4     01020         CALL    DECIM
F4C7 010100     01030         LD      BC,1
F4CA CDCEF4     01040         CALL    DECIM
F4CD C9         01050         RET
F4CE ED42       01060 DECIM   SBC     HL,BC
F4D0 3806       01070         JR      C,DSPLAY
F4D2 3C         01080         INC     A
F4D3 3242F5     01090         LD      (PRINT0),A
F4D6 18F6       01100         JR      DECIM
F4D8 09         01110 DSPLAY  ADD     HL,BC
F4D9 08         01120         EX      AF,AF'
F4DA 3A42F5     01130         LD      A,(PRINT0)
F4DD FE00       01140         CP      0
F4DF 2807       01150         JR      Z,SPACE
F4E1 08         01160         EX      AF,AF'
F4E2 C630       01170         ADD     A,30H
F4E4 12         01180 NEXT    LD      (DE),A
F4E5 13         01190         INC     DE
F4E6 AF         01200         XOR     A
F4E7 C9         01210         RET
F4E8 3E20       01220 SPACE   LD      A,32
F4EA 18F8       01230         JR      NEXT
F4EC 213DF5     01240 LAST    LD      HL,TEXT4
F4EF 010500     01250         LD      BC,5


ADDR   CODE   LINE   LABEL  MNEM   OPERAND


F4F2 EDB0       01260         LDIR
F4F4 C9         01270         RET
F4F5 45         01280 TEXT1   DEFM    'Enter number of copies required
                                       (max. 65535)
F521 20         01290 TEXT2   DEFM    '      N'
F528 72         01300 TEXT3   DEFM    'remaining          of'
F53D 20         01310 TEXT4   DEFM    ' LAST'
0001            01320 PRINT0  DEFS    1
0000            01330         END
00000 Total errors

TEXT4   F53D    NEXT    F4E4    SPACE   F4E8    DSPLAY  F4D8
DECIM   F4CE    PRINT0  F542    TEXT3   F528    TEXT2   F521
DONE    F48F    LOOP    F489    COUNT   F4AB    LAST    F4EC
NEXTHL  F45E    DECML   F484    CALCNO  F43E    BACKSP  F430
READ    F419    TEXT1   F4F5
```

Wordbee file copier

This is an expanded version of my original copier utility which will prompt for the number of copies required, print the required number whilst displaying a countdown and then return to the WORDBEE file.

To use it simply assemble it where required (I have an early 'BEE and as such have ORGed it at F400H), create your file, go to the monitor and using G xxxx (depending on where you have ORGed it) run the utility, enter the number of copies required (65535 max., not that I envisage anyone should require such a vast number of copies) and, after setting up the printer, press <RETURN> whereby the printer will spring to life and dump the required number of copies and then return to WORDBEE.

G. R. Laming,
Mile End,
SA.

```
1 REM ************************************
2 REM *      COPY INHIBITOR              *
3 REM *        DARREN YATES              *
4 REM ************************************
5 POKE775,167:Z$=CHR$(0):DIM TEMP%(23040)
6 PRINT"(CLR)(BLK)----------------------------------------"
7 PRINT"(BLUE)       ENIGMA PROTECTION MACHINE"
8 PRINT"(BLK)----------------------------------------"
9 PRINT"(C/DN)(C/DN) THIS PROGRAM TAKES A SELECTED PROGRAM         ENCODES OR DE
CODES IT AND"
10 PRINT"              SAVES IT ON DISC"
11 PRINT"(C/DN)(C/DN)(C/DN)(C/DN)(C/DN)          (1)  ENCODE A PROGRAM"
12 PRINT"(C/DN)          (2)  DECODE A PROGRAM"
13 PRINT"(C/DN)          PICK ONE....."
14 GETKEYCM$
15 IFCM$<>"1"ANDCM$<>"2"THEN14
16 REM ------ E N C O D E ------
17 PRINT"(CLR)(BLK)----------------------------------------"
18 PRINT"(RED)       MAXIMUM FILE SIZE=98 BLOCKS"
19 PRINT"(BLK)----------------------------------------"
20 IFCM$="1"THENPRINT"(BLUE)              ENCODING A FILE"
21 IFCM$="2"THENPRINT"(BLUE)              DECODING A FILE"
22 PRINT"(C/DN)(BLK) NAME OF FILE:";:POKE19,1:INPUTFILE$:POKE19,0:PRINT
23 PRINT"(C/DN) TYPE OF FILE....."
24 PRINT"(C/DN) (1)..PRG  (2)..SEQ  (3)..USR  (4)..REL"
25 GETKEYCOM$
26 IFVAL(COM$)<1ORVAL(COM$)>4THEN25
27 PRINT"(C/UP)(C/UP)(C/UP)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT
)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C
/RT)(C/RT)(C/RT)";COM$
28 ONVAL(COM$)GOTO29,30,31,32
29 TYPE$="PRG":GOTO33
30 TYPE$="SEQ":GOTO33
31 TYPE$="USR":GOTO33
32 TYPE$="REL"
33 PRINT"(C/DN)----------------------------------------"
34 PRINT"(BLUE) LOAD DISC INTO DRIVE AND PRESS RETURN"
35 PRINT"(BLK)----------------------------------------"
36 GETKEYCOM$
37 A$=PEEK(65286):POKE65286,PEEK(65286)AND239
38 CLOSE15:CLOSE5
39 OPEN15,8,15
40 OPEN5,8,5,"0:"+FILE$+",S,"+TYPE$+",R"
41 FORN=0TO23040:GET#5,DAT$:TEMP%(N)=ASC(DAT$+Z$):IFST=0THENNEXTN
42 CLOSE15:CLOSE5
43 POKE65286,A$
44 SCNCLR:IFCM$="1"THENPRINT"(C/DN)(C/DN)(C/DN)(C/DN)(C/DN)         NOW ENCODING
PROGRAMME....":GOTO46
45 PRINT"(6*DN)(C/DN)(C/DN)(C/DN)(C/DN)       NOW DECODING PROGRAMME...."
46 FORDL=1TO1000:NEXTDL
47 A$=PEEK(65286):POKE65286,PEEK(65286)AND239
48 LB=N:N=23040
49 LN$=STR$(LB/256)
50 FORN=1TOLEN(LN$):IFMID$(LN$,N,1)="."THENLN$=LEFT$(LN$,N+2):N=LEN(LN$)
51 NEXTN
52 PRINT"(CLR)(BLK)----------------------------------------"
53 PRINT"(GRN)        LENGTH OF FILE="LN$
54 PRINT"(BLK)----------------------------------------"
55 FORN=0TOLB:TEMP%(N)=255-(TEMP%(N)):NEXTN
56 POKE65286,A$
57 PRINT"(C/DN)(C/DN)(C/DN) NAME OF FILE:";:PRINTFILE$:PRINT"(C/UP)(C/RT)(C/RT)(
C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)(C/RT)";
58 POKE19,1:INPUTFILE$:POKE19,0:PRINT
59 PRINT"(C/DN)(C/DN)----------------------------------------"
60 PRINT"(GRN)-LOAD DISC INTO DRIVE AND PRESS RETURN"
61 PRINT"(BLK)----------------------------------------"
62 GETKEYCOM$
63 POKE65286,PEEK(65296)AND239
64 OPEN15,8,15
65 OPEN5,8,5,"0:"+FILE$+",S,"+TYPE$+",W"
66 FORN=0TOLB:PRINT#5,CHR$(TEMP%(N));:NEXTN
67 CLOSE5:CLOSE15
68 POKE65286,A$
69 PRINT"(CLR)(C/DN)(C/DN)(C/DN)(C/DN)(C/DN)(C/DN)(C/DN)----------------------
----------"
70 PRINT"(BLUE)       PRESS A KEY TO CONTINUE....."
71 PRINT"(BLK)----------------------------------------"
72 GETKEYCOM$:CLR
73 GOTO6
```

Copy inhibitor

This programme was written for the plus/4 and C16, but with small mods, it will also work on the C128 and C64. It takes a programme and jumbles it up, so it cannot be recognised and copied. To retrieve the protected programme, run it through the copy inhibitor and it will be in its original form.

Notes: Poke775 disables the list function.

Poke65286 turns the screen off to increase the speed of the programme.

D. Yates,
Frenchs Forest,
NSW.

```
10 PRINT "ENTER YOUR ";
20 COLOR 15,0 'highlight next word
30 PRINT "PASSWORD";
40 COLOR 7 'return to default (white on black)
50 PRINT " HERE: ";
60 COLOR 0 'invisible (black on black)
70 INPUT PASSWORD$
80 IF PASSWORD$="MYCONVRT" THEN GOTO 120
90 COLOR 7 'return to default (white on black)
100 PRINT "WRONG PASSWORD.....BYE..."
110 END
120 COLOR 7 'return to default (white on black)
130 PRINT "      $$$$$$$$$$$$$$$$$$$$"
140 PRINT "      $                  $"
150 PRINT "      $   CONVERSIONS!   $"
160 PRINT "      $        BY        $"
170 PRINT "      $      GEOFF       $"
180 PRINT "      $      CURRIE      $"
190 PRINT "      $      28.1.88     $"
200 PRINT "      $                  $"
210 PRINT "      $$$$$$$$$$$$$$$$$$$$"
220 PRINT "A) AREA"
230 PRINT "B) VOLUME"
240 PRINT "C) DENSITY"
250 PRINT "D) WORK"
260 PRINT "E) FORCE"
270 PRINT "F) VELOCITY"
280 PRINT "G) MASS"
290 PRINT "H) LENGTH"
300 PRINT "I) ACTIVITY"
310 PRINT "J) ENERGY"
320 PRINT "K) TEMPERATURE"
330 INPUT "MAKE A CHOICE BY LETTER FOLLOWED BY RETURN";A$
340 IF A$="A" GOTO 450
350 IF A$="B" GOTO 690
360 IF A$="C" GOTO 840
370 IF A$="D" GOTO 990
380 IF A$="E" GOTO 1140
390 IF A$="F" GOTO 1290
400 IF A$="G" GOTO 1560
410 IF A$="H" GOTO 1710
420 IF A$="I" GOTO 2330
430 IF A$="J" GOTO 2480
440 IF A$="K" GOTO 2760
450 PRINT "INCORRECT CHOICE. TRY AGAIN."
460 GOTO 210
470 PRINT "A) ACRES TO HECTARES"
480 PRINT "B) HECTARES TO ACRES"
490 INPUT "MAKE A CHOICE BY LETTER FOLLOWED BY RETURN";A1$
500 IF A1$="A" GOTO 540
510 IF A1$="B" GOTO 640
520 PRINT "INCORRECT CHOICE. TRY AGAIN."
530 GOTO 460
540 INPUT "HOW MANY ACRES?";A
550 H=A/2.47105
560 PRINT "HECTARES=";H
570 PRINT "1 HECTARE = 10000 SQUARE METRES"
580 INPUT "ANOTHER CONVERSION (Y/N) ?";A2$
590 IF A2$="Y" GOTO 220
600 IF A2$="N" GOTO 2900
610 PRINT "INCORRECT CHOICE. TRY AGAIN."
620 GOTO 580
630 END
640 INPUT "HOW MANY HECTARES?";H
650 PRINT "A) ACRES TO HECTARES"
660 A=H*2.47105
670 PRINT "ACRES=";A
680 GOTO 590
690 PRINT "A) LITRES TO GALLONS"
700 PRINT "B) GALLONS TO LITRES"
710 INPUT "MAKE A CHOICE BY LETTER FOLLOWED BY RETURN";B1$
720 IF B1$="A" GOTO 760
730 IF B1$="B" GOTO 800
740 PRINT "INCORRECT CHOICE. TRY AGAIN."
750 GOTO 690
760 INPUT "HOW MANY LITRES?";L
770 G=L*.21997
780 PRINT "GALLONS=";G
790 GOTO 580
800 INPUT "HOW MANY GALLONS?";G
810 L=G/.21997
820 PRINT "LITRES=";L
830 GOTO 580
840 PRINT "A) Kg per CUBIC METRE TO lb per CUBIC FEET"
850 PRINT "B) lb per CUBIC FEET TO Kg per CUBIC METRE"
860 INPUT "MAKE A CHOICE BY LETTER FOLLOWED BY RETURN";C1$
870 IF C1$="A" GOTO 910
880 IF C1$="B" GOTO 960
890 PRINT "INCORRECT CHOICE. TRY AGAIN."
900 GOTO 840
910 INPUT "HOW MANY Kg per CUBIC METRE?";K
920 P=K*.062428
930 PRINT "lb per CUBIC FEET=";P
940 GOTO 580
950 INPUT "HOW MANY lb per CUBIC FEET?";P
960 K=P/.062428
970 PRINT "Kg per CUBIC METRE=";K
980 GOTO 580
990 PRINT "A) KILOWATT HOURS TO JOULES"
1000 PRINT "B) JOULES TO KILOWATT HOURS"
1010 INPUT "MAKE A CHOICE";D1$
1020 IF D1$="A" GOTO 1060
1030 IF D1$="B" GOTO 1100
1040 PRINT "INCORRECT CHOICE. TRY AGAIN."
1050 GOTO 990
1060 INPUT "HOW MANY KILOWATT HOURS?";KH
1070 KH=J/(3600000!)
1080 PRINT "JOULES=";J
1090 GOTO 580
1100 INPUT "HOW MANY JOULES?";J
1110 KH=J/(3600000!)
1120 PRINT "KILOWATT HOURS=";KH
1130 GOTO 580
```

```
1140 PRINT "A) NEWTONS TO Kg"
1150 PRINT "B) Kg TO NEWTONS"
1160 INPUT "MAKE A CHOICE";E1$
1170 IF E1$="A" GOTO 1210
1180 IF E1$="B" GOTO 1250
1190 PRINT "INCORRECT CHOICE. TRY AGAIN."
1200 GOTO 1140
1210 INPUT "HOW MANY NEWTONS?";N
1220 N=KG/.101972
1230 PRINT "Kg=";KG
1240 GOTO 580
1250 INPUT "HOW MANY Kg?";KG
1260 N=KG/.101972
1270 PRINT "NEWTONS=";N
1280 GOTO 580
1290 PRINT "A) m/s TO km/h"
1300 PRINT "B) km/h TO m/s"
1310 PRINT "C) km/h TO MILES/h"
1320 PRINT "D) MILES/h TO km/h"
1330 INPUT "MAKE A CHOICE";F1$
1340 IF F1$="A" GOTO 1400
1350 IF F1$="B" GOTO 1440
1360 IF F1$="C" GOTO 1480
1370 IF F1$="D" GOTO 1520
1380 PRINT "INCORRECT CHOICE. TRY AGAIN."
1390 GOTO 1290
1400 INPUT "HOW MANY m/s?";MS
1410 KH=MS*3.6
1420 PRINT "km/h=";KH
1430 GOTO 580
1440 INPUT "HOW MANY km/h?";KH
1450 KH=MS*3.6
1460 PRINT "m/s=";MS
1470 GOTO 580
1480 INPUT "HOW MANY km/h?";KH
1490 MI=KH/.621371
1500 PRINT "MILES/h=";MI
1510 GOTO 580
1520 INPUT "HOW MANY MILES/h?";MI
1530 MI=KH/.621371
1540 PRINT "km/h=";KH
1550 GOTO 580
1560 PRINT "A) Kg TO lb"
1570 PRINT "B) lb TO Kg"
1580 INPUT "MAKE A CHOICE";G1$
1590 IF G1$="A" GOTO 1630
1600 IF G1$="B" GOTO 1670
1610 PRINT "INCORRECT CHOICE. TRY AGAIN."
1620 GOTO 1560
1630 INPUT "HOW MANY Kg?";K
1640 K=L/2.20462
1650 PRINT "lb=";L
1660 GOTO 580
1670 INPUT "HOW MANY lb?";L
1680 K=L/2.20462
1690 PRINT "Kg=";K
1700 GOTO 580
1710 PRINT "A) METRES TO FEET"
1720 PRINT "B) METRES TO YARDS"
1730 PRINT "C) FEET TO METRES"
1740 PRINT "D) YARDS TO METRES"
1750 PRINT "E) Cm TO INCH"
1760 PRINT "F) INCH TO Cm"
1770 PRINT "G) Km TO MILES"
1780 PRINT "H) MILES TO Km"
1790 PRINT "I) Km TO NAUTICAL MILES"
1800 PRINT "J) N.MILES TO Km"
1810 INPUT "MAKE A CHOICE";H1$
1820 IF H1$="A" GOTO 1930
1830 IF H1$="C" GOTO 2010
1840 IF H1$="D" GOTO 2050
1850 IF H1$="E" GOTO 2090
1860 IF H1$="F" GOTO 2130
1870 IF H1$="G" GOTO 2170
1880 IF H1$="H" GOTO 2210
1890 IF H1$="I" GOTO 2250
1900 IF H1$="J" GOTO 2290
1910 PRINT "INCORRECT CHOICE. TRY AGAIN."
1920 GOTO 1710
1930 INPUT "HOW MANY METRES?";M
1940 M=F/3.28084
1950 PRINT "FEET=";F
1960 GOTO 580
1970 INPUT "HOW MANY METRES?";M
1980 M=Y/1.09361
1990 PRINT "YARDS=";Y
2000 GOTO 580
2010 INPUT "HOW MANY FEET?";F
2020 M=F/3.28084
2030 PRINT "METRES=";M
2040 GOTO 580
2050 INPUT "HOW MANY YARDS?";Y
2060 M=Y/1.09361
2070 PRINT "METRES=";M
2080 GOTO 580
2090 INPUT "HOW MANY Cm?";C
2100 I=C/2.54
2110 PRINT "INCHES=";I
2120 GOTO 580
2130 INPUT "HOW MANY INCHES?";I
2140 I=C/2.54
2150 PRINT "Cm=";C
2160 GOTO 580
2170 INPUT "HOW MANY Km?";K
2180 K=M/.621371
2190 PRINT "MILES=";M
2200 GOTO 580
2210 INPUT "HOW MANY MILES?";M
2220 K=M/.621371
2230 PRINT "Km=";K
2240 GOTO 580
2250 INPUT "HOW MANY Km?";K
2260 N=K*.539957
2270 PRINT "NAUTICAL MILES=";N
2280 GOTO 580
2290 INPUT "HOW MANY N.MILES?";N
2300 K=N/.539957
2310 PRINT "Km=";K
2320 GOTO 580
2330 PRINT "A)mCi TO MBq"
2340 PRINT "B)MBq TO mCi"
2350 INPUT "MAKE A CHOICE";I1$
2360 IF I1$="A" GOTO 2400
2370 IF I1$="B" GOTO 2440
2380 PRINT "INCORRECT CHOICE. TRY AGAIN."
2390 GOTO 2330
2400 INPUT "HOW MANY mCi?";C
2410 M=C*37
2420 PRINT "MBq=";M
2430 GOTO 580
2440 INPUT "HOW MANY MBq?";M
2450 M=C*37
2460 PRINT "mCi=";C
2470 GOTO 580
2480 PRINT "A) JOULES TO CALORIES"
2490 PRINT "B) CALORIES TO JOULES"
2500 PRINT "C) JOULES TO MeV"
2510 PRINT "D) MeV TO JOULES"
2520 INPUT "MAKE A CHOICE";J1$
2530 IF J1$="A" GOTO 2590
2540 IF J1$="B" GOTO 2630
2550 IF J1$="C" GOTO 2670
2560 IF J1$="D" GOTO 2710
2570 PRINT "INCORRECT CHOICE. TRY AGAIN."
2580 GOTO 2480
2590 INPUT "HOW MANY JOULES?";J
2600 J=C/.238846
2610 PRINT "CALORIES=";C
2620 GOTO 580
2630 INPUT "HOW MANY CALORIES?";C
2640 J=C/.238846
2650 PRINT "JOULES=";J
2660 GOTO 580
2670 INPUT "HOW MANY JOULES?";J
2680 M=J/(1.6E-13)
2690 PRINT "MeV=";M
2700 GOTO 580
2710 INPUT "HOW MANY MeV?";M
2720 M=J/(1.6E-13)
2730 PRINT "JOULES=";J
2740 GOTO 580
2750 PRINT "A) CELCIUS TO FARENHEIT"
2760 PRINT "B) FARENHEIT TO CELCIUS"
2770 INPUT "MAKE A CHOICE";K1$
2780 IF K1$="A" GOTO 2820
2790 IF K1$="B" GOTO 2860
2800 PRINT "INCORRECT CHOICE. TRY AGAIN."
2810 GOTO 2750
2820 INPUT "HOW MANY DEGREES CELCIUS?";C
2830 F=(C*1.8)+32
2840 PRINT "DEGREES FARENHEIT=";F
2850 GOTO 580
2860 INPUT "HOW MANY DEGREES FARENHEIT?";F
2870 C=(F-32)/1.8
2880 PRINT "DEGREES CELCIUS=";C
2890 GOTO 580
2900 PI=3.141593
2910 SCREEN 1 'medium res. graphics
2920 COLOR 0,1 'black background, palette 1
2930 'two circles in color 1 (cyan)
2940 CIRCLE (120,50),10,1
2950 CIRCLE (200,50),10,1
2960 'two horizontal ellipses
2970 CIRCLE (120,50),30,,,5/18
2980 CIRCLE (200,50),30,,,5/18
2990 'arc in color 2 (magenta)
3000 CIRCLE (160,0),150,2,1.3*PI,1.7*PI
3010 'arc, one side connected to center
3020 CIRCLE (160,52),50,,1.4*PI,-1.6*PI
3030 PRINT "HAVE A NICE DAY!"
3040 PRINT
```

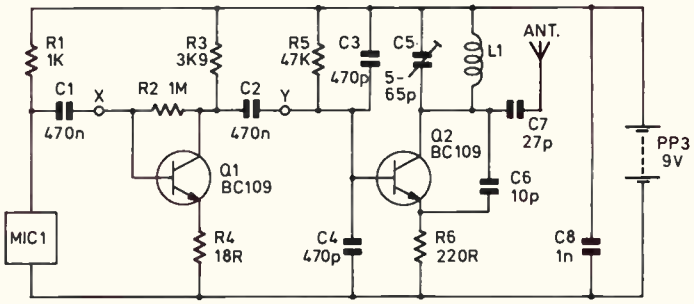
Conversions

This programme was written on an IBM AT computer for the conversion of many commonly used imperial units of measurement to metric and back again.

The programme also contains a password entry and graphics.

Geoff Currie,
Compbelltown,
NSW.

Circuits



FM bug

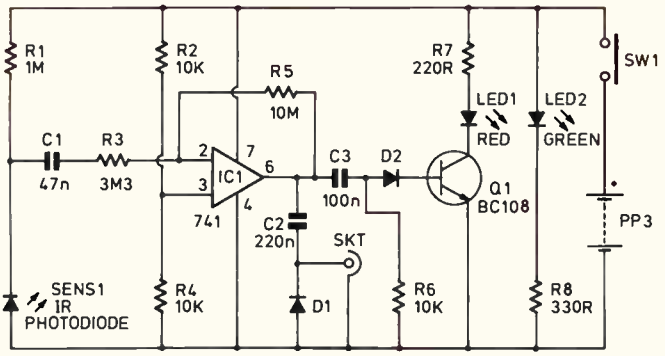
This circuit operates as a small FM 'bug' transmitting on FM somewhere between 88 and 108 MHz. Certain uses of this are of course completely illegal.

Just how small the bug is will be limited only by your design skills, although the PP3 battery prevents concealment in a telephone or secret flower vase.

The microphone signals are amplified by Q1 (if a less sensitive unit is used you could miss out R2,3,4,C2 and Q1).

Q2 operates as a ground-based oscillator, frequency determined by C5 and L1 and feedback derived from C6 (a fairly critical component — 10p should secure oscillation). As the audio signals arrive at Q2, the centre frequency of oscillation is shifted slightly producing the desired FM.

The mic is a small electret with integral amplifier, L1 is five turns of 20swg wire of 12 mm diameter. 125 mm of insulated wire will serve as an antenna. C5 is variable to tune the transmitted frequency.



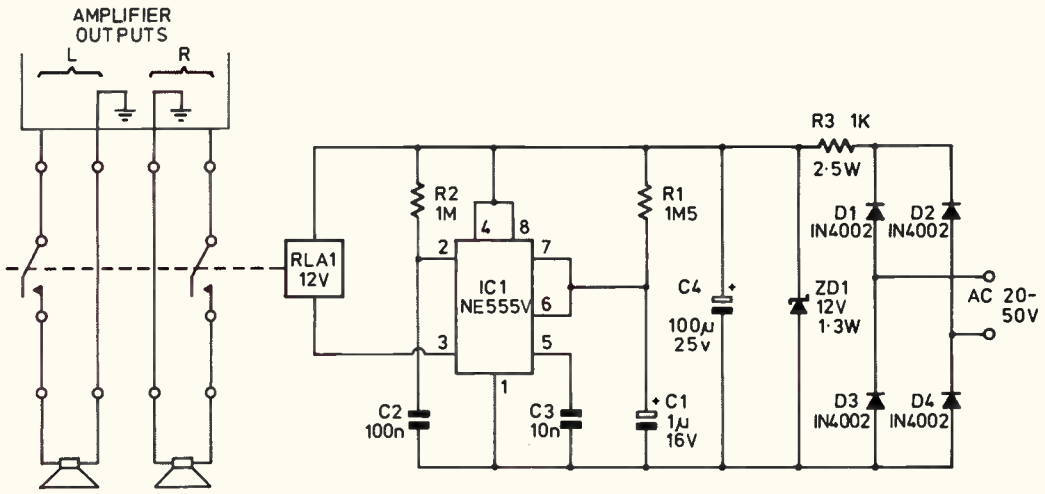
Infra-red fault finder

Every TV service engineer knows the difficulty in deciding whether a faulty infra-red link is malfunctioning in the receiver or the transmitter. A scope is the normal solution, but this cheap and simple circuit is far more convenient.

The infra-red receiving diode D3 is reversed biased as normal and the pulses are passed to IC1 with the sensitivity reduced by the 3M3 resistor — this prevents the diode reacting to ambient light. IC1 feeds Q1 to indicate a received signal on LED1, and also passes the signal to a dc clamped socket for an oscilloscope (should further investigation be required). LED2 indicates power on and will dim when the battery is waning.

The unit will receive up to about 400 mm from a reasonable transmitter.

SENS1 can be any infra-red photodiode.



Anti-thump circuit

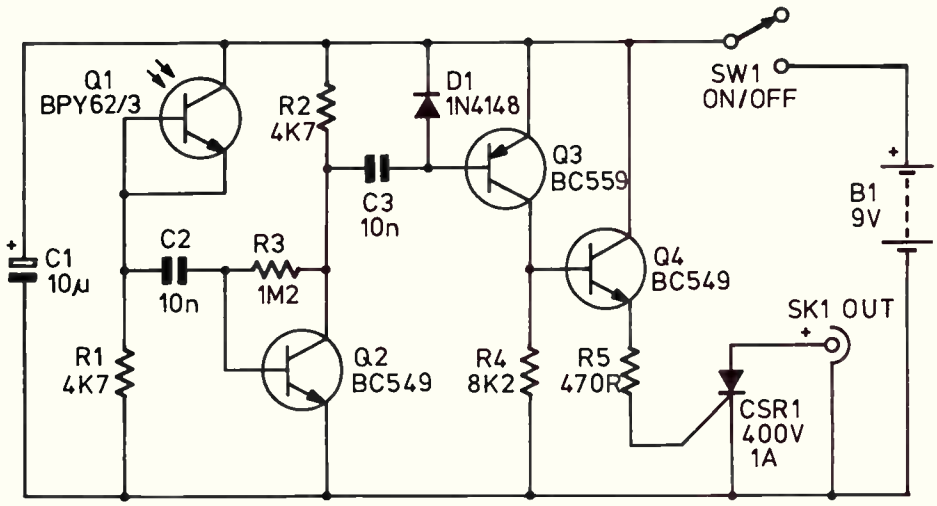
When a power amplifier turns on there is usually a fairly large dc offset on the output until the dc blocking capacitors charge up.

The resulting 'thump' on the loudspeakers is potentially damaging, particularly if the speakers are under-rated. This circuit initiates a delay between switch on and speaker connection. There is no delay at switch off.

IC1 is a 555 in monostable mode, triggered by a negative going edge provided by R2 and C2. The output goes to the negative rail during the output pulse, so the relay is connected between the output and positive.

The time delay is approximately 1.1xC1xR1 — about 4 seconds with the components shown.

High sensitivity flash slave



For many years flash slave units have been preferred by many photographers to wiring up multiflash systems with flash cables and adapters. A few cables might seem nothing more than a minor inconvenience but in reality they act as excellent trip-wires which can easily result in a lot of damaged equipment (and possibly injured photographers as well!).

A flash slave unit is really nothing more than a light activated switch. It senses the pulse of light from the main flashgun (normally on or near the camera) and triggers a second flashgun. If more than two flashguns are needed, it is merely necessary to have a slave unit for each secondary flashgun.

In this way it is possible to have quite complex flash lighting arrangements that are completely devoid of any connecting cables.

Although a flash slave unit is just a light activated switch, to work well it must have suitable characteristics. In particular, it must operate very fast. With the shutter set to the fastest flash synchronisation speed and a powerful gun in use, the shutter may not stay fully open for much longer than the flash duration. A reasonably fast form of photocell must be used and a solid state switching device at the output is definitely preferably to a relay.

To work well the unit should also have high sensitivity and operate over a wide range of ambient light levels.

This circuit uses a photo-transistor as the detector together with a thyristor as the output device and these ensure a fast response time. Some flash slave units avoid the need for a battery by either using a photosensitive thyristor, or extracting power from the flashgun. This circuit was designed primarily with high performance and reliability in mind and it was decided to opt for a battery supply rather than to compromise with a so-called 'self-powered' circuit.

The higher than average sensitivity is obtained by using a comparatively large gain in the circuit but with ac coupling to minimise any problems with the unit saturating under bright conditions.

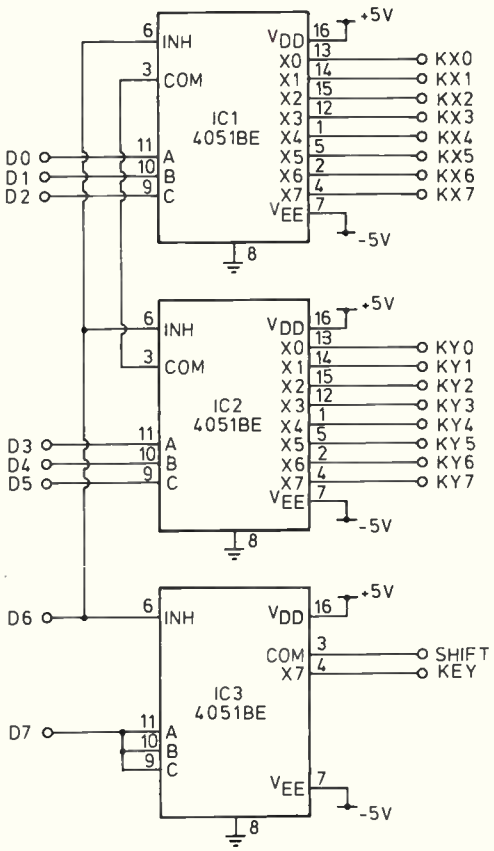
Q1 is the photo-transistor and it is connected in the emitter follower mode. Its base is tied to its emitter, which gives lower sensitivity than if it was to be given a small forward bias or just left unconnected. However, the overall sensitivity of the circuit is still excellent and the relatively low sensitivity of Q1 itself gives good immunity to the unit being saturated in high ambient light levels.

When Q1 detects a pulse of light from the primary flashgun, this causes a small increase in its leakage current. This in turn results in an increase in its emitter voltage and this signal is coupled by C2 to the input of a common emitter amplifier based on Q2. Here it is substantially amplified and the strong negative pulse produced is coupled by C3 to the base of Q3 which is switched on, supplying a trigger current to CSR1 via emitter follower buffer stage Q4 and current limiting resistor R5.

The thyristor is driven with a gate current of nearly 20 mA and even inexpensive, insensitive types should work well in this circuit (R5 can be reduced in value if necessary).

The unit will only work properly if the flashgun is connected to CSR1 with the polarity shown in the circuit diagram. The 'suck it and see' method can be used to find the correct polarity if you do not have a multimeter (note that the voltage on the flashlead is quite high — 175 V).

If a miniature coaxial socket for SK1 cannot be obtained, a socket and short length of cable cut from a flash extension lead can be used here. The unit is very sensitive but there must still be reasonably effective path for the light from the main gun to reach Q1. Aiming Q1 straight at the main flashgun is not usually necessary, reflected light is generally sufficient to give reliable operation.



Pseudo co-processing

This circuit provides a use for an old computer by placing it under the control of another machine.

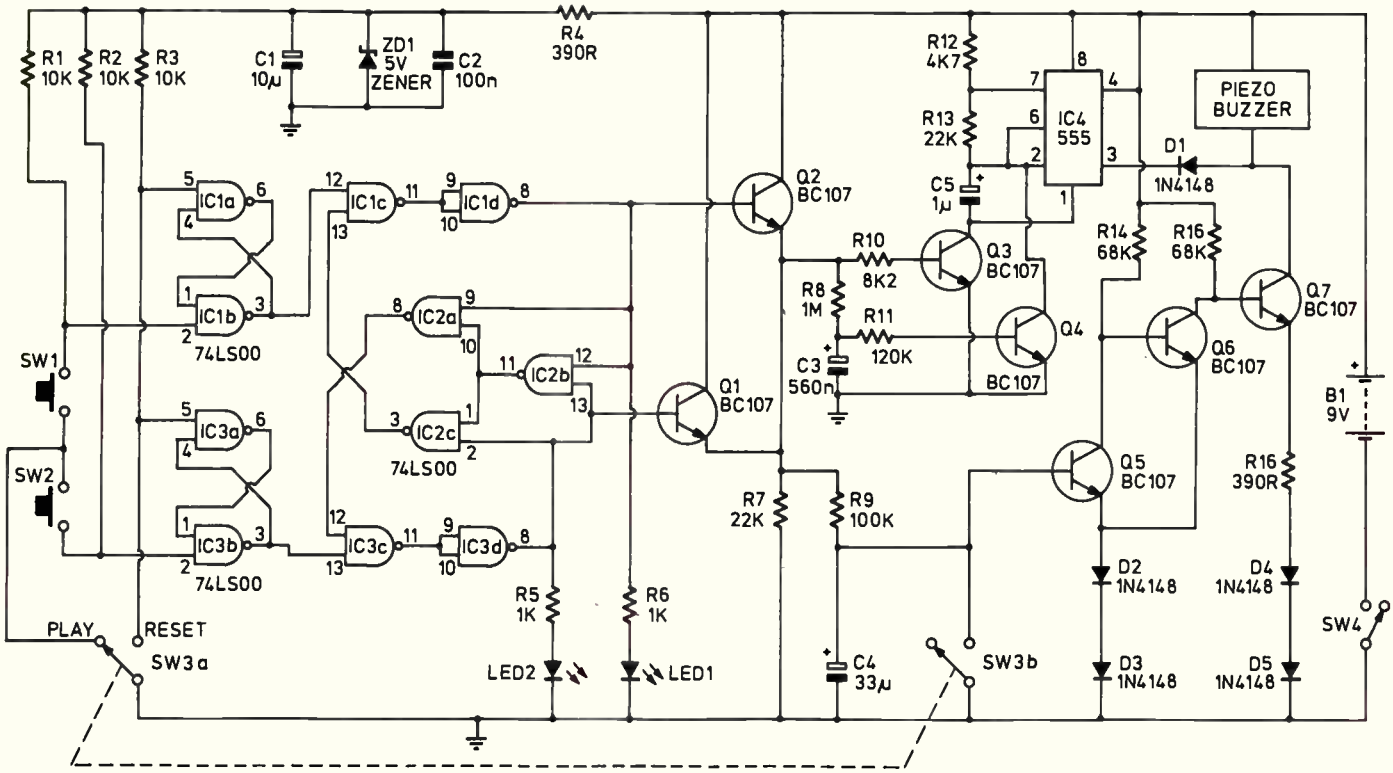
It can find applications as a printer buffer, for interfacing incompatible hardware, multi-processing, interfacing incompatible programs and many other ideas.

The principle is simply to control the old computer via a keyboard of the host computer. All that is needed on the new computer is an 8-bit output port.

The keyboard of the slave micro is controlled by the three analogue switch ICs. The outputs marked K are connected to the ribbon cable connected to the keyboard matrix in the slave machine. Experimentation is required to find which key is connected to which terminal of the ribbon connector.

64 keys can be controlled in this way. The Shift key is required to be controlled separately (so it can be used in conjunction with the others). Bit 7 of the output port controls the Shift key.

The host computer can, with this interface, type programs into the slave micro, run them, enter data and all manner of other tasks.



Electronic game switch

This circuit was devised to determine which of two players first hit their answer button and to allow a preset time for the answer when playing any game that requires a decision on who was first (e.g: Snap) or timing for some task.

The circuit gives both visual (an LED) and audible (a warble) indications that a button has been pressed and locks out the other button. A continuous tone is given as the 'time up' signal at the end of the allotted answering time.

IC1a, b and IC3a, b debounce the two answer buttons SW1 and SW2 respectively. Assuming Reset has just been pressed, both LEDs will be off the pin 3 of IC1b and IC3b will be low. IC1d inverts this action, lighting LED1. Q2 is turned on supplying pawer to R8, C3 and R10 which switch on Q3 and pawer IC4 giving a warble from the piezo buzzer. Approximately 0.3 S later Q4 is turned on cutting off the pawer to IC4 and curtailing the warble.

When IC8 goes high it takes pin 9 of IC2a and pin 12 of IC2b high also. This takes pin 13 of IC3 low, locking out the action of SW2.

If SW2 is pressed first, the action is reversed with SW1 locked out.

Whichever button is pressed, pawer is supplied via Q1 or Q2 to Q5 after C4 has charged (about 3.5s). After the delay Q5 conducts turning off Q6 and turning on Q7 which enables a continuous tone from the buzzer.

The whole system is reset by the switch SW3 which discharges C4 and resets the push botton logic.

Current consumption is about 10mA in standby and 20mA when buzzing (depending on the buzzer used). A PP3 battery should cope without problems.

Extra switches can of course be added in parallel with the ones given for playing the game in teams.

Letters

Request time

I like the glossy new format. And the new format articles on science and other subjects are interesting.

How about an audio phaser/flanger project that does not cost the earth like some commercial ones do?

Mark Turnham,
West Doncaster,
Vic.

★ ★ ★

More information on Cape York Space Port progress please and more information on R & D in science and medical fields.

How abaut a profile on engineers (electronic) employers, salary, activities?

Mark Walpole,
Wilston,
Qld.

★ ★ ★

I would like to see more computer contents, "road tests" of Marine Electronics. Like marine radar, satnav, marine radio, etc.

Keep up the good work.

W. Grevling,
Geilston Bay,
Tas.

Keep reading for marine electronics.

— Ed

★ ★ ★

Great magazine! But how about some projects on "lasers".

Stephen O'Young
Beacon Hill, NSW

★ ★ ★

I am so impressed with your new magazine format that I have finally subscribed.

Stephen Anderson
Stafford, Qld.

★ ★ ★

Infuriated but happy!

Arty undergraduates publishing pretentious quarterlies do it. Ephemeral trade publications do it. Girlie magazines with aspirations to grandeur do it. Glossy advertisements for pay-now, die-later undertakers do it. But you, sir, should know better.

White print on shiny black background, black print on shiny blue background, black print on grey wash: INFURIATINGLY hard to read.

Top marks for the rest of the revamp.

L. A. Turner
Black Rock, Vic.

Five dollar cart

I read with interest an article called "Eprom Programmer" (September 1988). .

Is it possible to obtain a copy of the program which drives the circuit as illustrated as the circuit without software is a bit like a horse without a cart.

Dr Ken Koschel,
Peter MacCallum Institute,
Melbourne, Vic.

A full listing was published on page 50 ETI February '83 with the original article. Photocopies are available from ETI at $5.

— Ed

Real world

Let me say that I totally approve of the direction taken by your magazine. It has always been excellent but your inclusion of a wider variety of topics such as the technical side behind such topical tragedies (no pun intended) as the Vincennes disaster makes it a much more rounded and informative magazine, which is in the real world not just the sometimes artificial eletronics world. Great work and keep it up.

L. Fanchette,
East Melbourne,
Vic.

We tried . . .

"My Last Subscription": I first subscribed to ETI about 10 years ago when it was for those interested in electronics, circuits and projects. Now it is full of ads for CDs, Audiovisual gear and something for everyone but little for anyone. Is this electronic or business progess?

Either your magazine must change or I must subscribe to a different one. Maybe others like it but not I.

R. Hicks,
Northbridge,
NSW.

Dregs fan

Your authors have a great sense of humour. I love Dregs. Go for it.

Colin Stone,
East Ringwood,
Vic.

Welcome aboard

It is the first time that I have purchased your magazine, but if the standard of publication is kept up, it will certainly not be the last.

Keep up the good work.

Sergio Poldi,
Maidstone,
Vic.

Off-centre

I've been an enthusiastic reader of ETI for a number of years and have seen many changes to the magazine all of which were for the better including the new glossy cover. I have only one complaint which I think would be backed by a number of people. Why are the page nos printed on the bottom centre of the page, would you please put them back on the bottom right of the page.

Scott Bevis,
Bracken Ridge,
Qld.

Life's like that

The magazine is great. I have been reading it for 3 years and love it.

Only one complaint. These supplements and special editorials which are given their own page numbers make life hell trying to get to the standard ETI articles.

Thank you.

Michael Groeneweg,
Spearwood,
WA.

Inspired

Your editorial 'Education-why is it so' (October 1988) was most interesting. Maths need not be boring but poor teaching makes it so. Regrettably there are few good, inspiring maths' teachers. Either industry or administration pirate them. The same thing goes for science. I love teaching maths and my students (girls and boys) love it too.

J. A. Coulson,
Dilston,
Tas.

Woomera lives

The item 'Vale Woomera — Hail Cape York' (ETI, August, 1988) makes some paints that require further elaboration, particularly to highlight Australian achievements in space.

Australia's first satellite, Wresat, was launched on a US Redstone rocket from Woomera on November 29, 1967. Built by University of Adelaide physicists, Wresat made 642 orbits, downloading solar ultraviolet flux and atmospheric spectroscopy data. The only other Australian made satellite Australis -Oscar V was launched on January 23, 1970 at Cape Carnaveral to provide amateur radio operators with three months contact. However, the British Prospero satellite was launched from Woomera on October 28, 1971 using a Black Arrow rocket.

Thus the claim in your article, that the ELDO Europa rocket made three successful orbital flights from Woomera, is incorrect as only sub-orbital trajectories were achieved. Details of historic and current Australian space programmes will be found in the December 1988 Bicentennial issue of the Journal of the British Interplanetary Society to be published in London. This issue has been prepared by members of the National Committee on Space Engineering of the Institution of Engineers Australia.

Following the Fourth National Space Engineering

Symposium at Adelaide in July, a group of delegates travelled to the Woomera rocket rangehead to inspect working facilities and historic remnants. With the co-operation of the Defence Science and Technology Organisation (DSTO), the visitors had the opportunity to inspect the launch control centre, tracking antennae and launch pads. Apparently, few people realise that the Woomera complex has operational status and indeed has been used recently to launch NASA sounding rockets for observations of the supernovae. Despite this status, apparently no representatives from the Cape York Space Base consortia have visited the site.

Woomera township is also well maintained, with many new houses built for personnel serving at the Nurrungor Joint Defence Space Communications Station, as well rangehead staff.

A new computer system has recently been installed in the Woomera launch command centre. From this large, multi-storey building, all launches are controlled and telemetry received for analysis. Briefing rooms, laboratories and other support facilities are located in this air-conditioned and fortified building, that stands like a fortress on the flat plain of gibber stones. Nearby, various tracking antennae are located, along with workshops, generators and the airfield with its hangars.

About a kilometre from launch control, lie several international sounding rocket launch pads and gantries, including Australia's own structure. A block house and fuel handling facilities adjoin this solid complex. to the north-west are several thousand hectares of essentially empty land, which is the main reason for the original selection of the Woomera rangehead site.

On a sad note, the visitors inspected the remains of the two large ELDO launch pads located some distance from Woomera, at Lake Hart. Used to launch Blue Streak/Europa vehicles, these costly structures have been largely destroyed by intention and army exercises. Only the concrete flame trench structures remain, with their derelict launch control centre located nearby. It seems odd that the decision was made top return these facilities "back to nature" as their remains are hardly describable as natural. The old pads and support structures now need historic markers, such as their counterparts have at Cape Carnaveral.

Back in Woomera township, the main accommodation complex where the visitors stayed is still known as the ELDO Mess.

The Woomera Heritage Centre museum has a variety of rocket and payload artifacts, pictures, models and historic plaques to remember earlier, busier days. Soon, the official history of Woomera should be printed. Entitled *Fire Across the Desert* by Peter G. Morton, the study has been sponsored by the DSTO.

During the Adelaide Symposium, delegates had the opportunity to visit the DSTO Salisbury Laboratories and witness the test firing of an Ikara missile. The testing complex has been recently renovated, and this was only the second successful firing. After that noisy experience, delegates moved on to inspect the satellite transmission systems laboratories, which have a variety of antennae, including precision ex-ELDO alt-azinuth mounts transferred down from Gove, N.T. Clearly, the DSTO is back in the space race!

Matthew L. James,
Convenor.
Aust. Space Policy Inst.
Canberra
ACT

Feed Forward needs your minds. If you have ideas for circuits that you would like to enter in our idea of the month contest, programs for the computing columns or just want a word with the editor, send your thoughts to:

Feed Forward
ETI, Federal Publishing,
PO Box 227,
Waterloo, NSW 2017

Contributors can look forward to $20 for each published idea/program which should be submitted with the declaration coupon below.

Programs MUST be in the form of a listing from a printer. You should indicate which computer the program is for. Letters should be typewritten or from a printer, preferably with lines double spaced. Circuits can be drawn roughly, because we have a draughtsman who redraws them anyway, but make sure they are clear enough for us to understand.

'Idea of the month' contest

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Soldering Station (model ETC60L) worth approximately $191.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine.

RULES

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each coupon. Photostats or clearly written copies will be accepted. You may send as many entries as your wish.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

COUPON

Cut and send to: **Scope-ETI 'Idea of the Month' Contest/ Computing Column, ETI Magazine, PO Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea/program in ETI Magazine or other publications produced by it. I declare that the attached idea/program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."*

* Breach of copyright is now a criminal offence.

Title of idea/program .....

Signature ..... **Date** .....

Name .....

Address .....

..... **Postcode** .....

COMING EVENTS

REGULAR MEETINGS

Club Mac meets the second Wednesday of each month in Lecture Theatre 5, Carslaw Building, Sydney Uni at 6.30 pm. Contact Brian Hinder ☎ (02) 660-5530.

ARCAD/GDS User Group meetings are held in Sydney the first Tuesday of every month. For information contact Klaus Bartosch ☎ (02) 958-2388.

The Apricot-Victor Users' Group meets the last Wednesday of every month at 6.15 pm at Prince Henry's Hospital, Melbourne. Contact Elizabeth Lyons ☎ (03) 611-2873.

The C Language Users' and Enthusiasts' Society (CLUES) meets at Frenchs Forest in Sydney on the first Tuesday of the month. Contact Jim Sharples ☎ (02) 958-4705.

The Australasian Lotus Users' Group meets on the first Tuesday of each month at 5.45 pm. Contact Barry Roberts ☎ (03) 267-4844.

The NSW branch of the **Office Automation Association** meets the last Wednesday of each month at the Commercial Travellers Club in Sydney from 6 pm-8 pm. Contact Pat Reid ☎ (02) 371-5132.

Western Australia Unix Systems Group meets on the third Wednesday of each month. Contact Sam Pascoe ☎ (09) 470-3077.

Special Interest Groups of PC users: CONSIG meets on the first Wednesday of each month in Sydney; ☎ (02) 290-2655. The DTP Graphics SIG (Desktop) meets on the second Tuesday of the month in Sydney; ☎ Mark Richards (02) 929-5855. PCWEST meets on the first Monday of the month in Sydney; ☎ Bill McEwen (02) 627-2488. ACS Expert Systems SIG meets third Monday of each month in Melbourne; ☎ Tony Davidzik ☎ (03) 873-1664.

The **NEC Users' Group of NSW** meets at St Leonards, Sydney, on the second Tuesday of each month. Contact Ian Cowell ☎ (02) 489-1156.

The **CAT-dBase Users Group** meets every third Tuesday of the month at 6.30 pm at Expert Technology Training, 185 Elizabeth Street, Sydney. Contact Hans Schneider ☎ (02) 309-2961.

The **South Australian Apple Users' Club** meets the first and third Fridays of the month at the Prospect Town Hall at 7.30 pm. Contact Ian Bagust ☎(08) 293-7183.

The Vic branch of the **Australian Dataflex Users Group** meets the second Wednesday of each month at Bird Cameron, 316 Queen Street, Melbourne, at 6 pm. ☎ (052) 21-1300 or (03) 670-9212.

FEBRUARY

4-17: Beyond 2000 Spectrum Exhibition. Royal Exhibition Building, Melbourne. Information from Spectrum Exhibitions. (02) 281-2555.

13-17: The World Conference on Engineering Education for Advancing Technology will be held at the University of Sydney. Contact the Conference Manager, Institution of Engineers, 11 National Circuit, Barton, ACT 2600.

20-25: Asia Telecom 89 in association with the ITU and Telecom Singapore ☎ +65 730 3935

MARCH

14-17 biannual: PC89 The 12th Australian Personal Computer Show at Darling Harbour, Sydney. Contact ☎ (03) 267-4500.

14-17 annual: Elenex Australia The Australian International Electrical & Electronic Industries Exhibition at Darling Harbour Sydney on ☎ (03) 267-4500.

APRIL

10-14: National Engineering Conference, Perth. More information from the Institution of Engineers Telex AA62758

17-19 Australian Symposium on Signal Processing and Applications (ASSPA) at the University of Adelaide. The exibition will run concurrently. Ph. (08) 267-1755.

27: The Institution of Engineers, Australia, has called for papers for a conference on **New Business Applications of Information Technology,** to be held in Melbourne. ☎ (062) 70-6549.

27-29 The Computer '89 computer show will be held at the Perth Entertainment Centre. Contact Swan Exhibitions ☎ (09) 443-3400.

MAY

3-5: An international working conference called **Shaping Organisations, Shaping Technology** will be held at Terrigal, near Sydney. Papers must be received for review by September 30. Contact Roger Clarke ☎ (062) 49-3666.

10-12: There's been a call for papers for the **Fourth Australian Software Engineering Conference,** ASWEC 89, to be held in Canberra. ☎ (062) 70-6549.

16-June 2: Fifth UN course on Agrometerological and Hydrological remote sensing. More informatin from COSSA. Fax: (062) 73-3958.

JUNE

6-9: PC89 The 13th Australian Personal Computer Show, Communications 89. The 5th Australian International Electronic Communictions and Information Technology Exhibition and Office Technology 89. The 4th Australian International Office Technology Exhibition will be held at Royal Exhibition Building Melbourne. Contact AES or ☎ (03) 267-4500.

JULY

12-14: The 8th Australian Conference on Microelectronics is being held in Brisbane next year. The theme is ASIC design. Details ☎ (062) 70-6549.

31-August 4: EEI '89 The First Electrical Engineering International will be held at the Royal Exhibition Bulding, Melbourne. ☎ (02) 331-5276.

AUGUST

7-15: Computer Olympiad for intelligent computer games is on in London, UK. ☎ 441 624 5551.

SEPTEMBER

11-15: Ireecon '89: IREE has called for papers and is booking exhibition space. The exhibition is being held at the Exhibition Hall, Melbourne. Bookings ☎ (02) 327-4822.

August 1991: International Joint Conference on Artificial Intelligence in Sydney. Contact Lynne Thomson ☎ (062) 64-3797.

OCTOBER

3-8: ITU-Com 89, The first summit for electronic media. The theme is 'Towards global information'. More information on 41 22 99-5190 in Geneva.

NOVEMBER

28-30: Fifth National Space Engineering Symposium in Canberra is being organised by the Institute of Engineering. Tlex AA62758.

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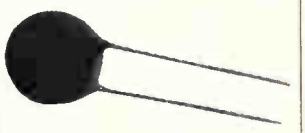

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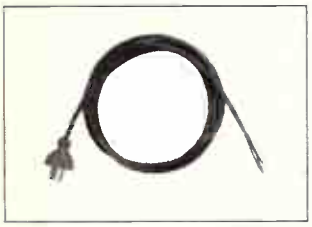

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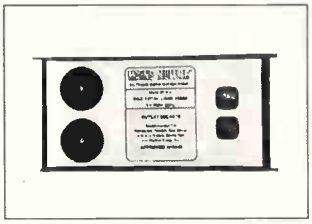

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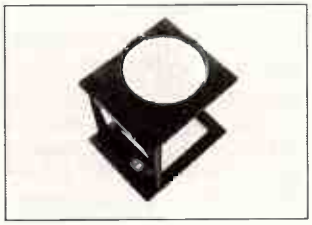

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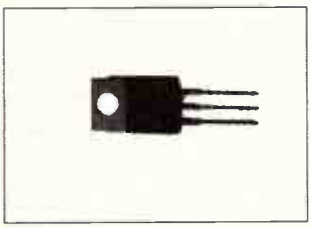

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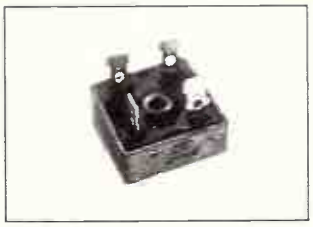

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THE TRUTH AT LAST

The Shroud unmasked, exposed microwaves

Readers of this humble column are becoming increasingly restive. First I was accused of a lack of taste for suggesting that the bosses' hiring practises left something to be desired (ETI May 88). Then, a throw away line about Nancy Reagan (ETI Sept 88) and the suggestion that she might be influenced by Creationism created a storm of protest. Meawhile, Queenslanders breathed heavily and threatened to send some surplus wallopers down to sort "youse southerners" out, over consistent allegations in this column that intelligence quotient and latitude are inversely related in Australia.

This month we will be tasteful, decorous and we will make no cheap gags at the expense of our sun-maddened Northern cousins.

However, when in doubt, the superpowers and their antics are always a useful target. A recent issue of New Scientist, the British science news magazine, records that between 1953 and 1976, the American embassy in Moscow was flooded with micowaves. The radiation was apparently detected during routine electromagnetic sweeps of the embassy buildings. Apparently, it was not part of a communications system, since there appeared to be no modulation of the system, nor was there any identifiable point source within the embassy that could be a transmitter.

So what was it for? One explanation is perhaps that the Russians had been reading up the literature on the harmful effects of electromagnetic radiation on human beings, and were using a compound of Yanks as a test sample. If so, did it work? We shall never know.

But it does raise questions about our regular exposure to EM radiation from sources like microwave links, radar, and high voltage distribution systems. The same issue of New Scientist records that the output from the Fylingdales early warning radar in England has so much power it is theoretically capable of microwaving a cow in an adjacent field. Did it? Are the local cockies up in arms about the loss of their livestock? Alas, another question we can't answer.

The Shroud

Which brings us to a question we can answer. Long term readers will recall an article on the Shroud of Turin (May 1981). The central proposition was that a bit of cloth, held at a church in Turin, was in fact used to wrap the body of Christ. Evidence for this was found in the figure of a man, evidently etched into the fabric, and supposedly the result of some mysterious radiation that flew from the dead body of Christ.

In an effort to prove that the Shroud dated, in fact, from 0 AD, small fragments of it have been dated by three different laboratories in Britain, Switzerland and the United States, using Carbon 14 radioactive decay. Unfortunately, it turns out that the cloth for the shroud was woven sometime between 1262 and 1384.

A fake? The church establishment has acted with commendable calm to reassure the faithful that one shonky shroud is not the end of the world as we know it. But most discussion has centred on the identity of the faker, or fakers.

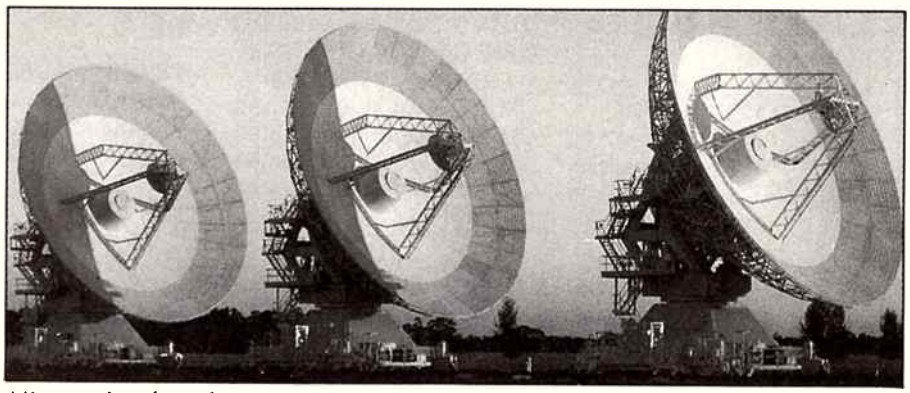
Earliest extant records of the shroud date from about the 12th century when it turned up in the hands of one Geoffrey de Charney, who claimed to have discovered the burial Shroud of Christ in Turkey.

It has long been suggested that Geoff was one of the original Dodgy Bros. Something of a shifty character, he is supposed to have spent most of his life mixed up with heathens in the Mid East. On his return to France, it is suggested that the Shroud was used as a central plank in boosting the local tourist trade in the South of France.

During the middle ages, the remains of the saints, "relics', were an object of veneration by the local yokels, and some not so local. In fact, people would travel across half of Europe to visit the bones of some poor, usually tortured, soul in the hope of redemption.

Clearly, it was an environment ripe for the unscrupulous, and the display and trade of any old bones became something of a scandal across Europe. It also became essential for any self respecting town to have at least something for visitors to look at. The circumstantial evidence is that Geoff and some of the senior officials in the local clergy conspired to get themselves a relic that would go one better than the opposition. To their credit, it worked. Turin has never looked back.

And you thought graft and corruption started in this century.

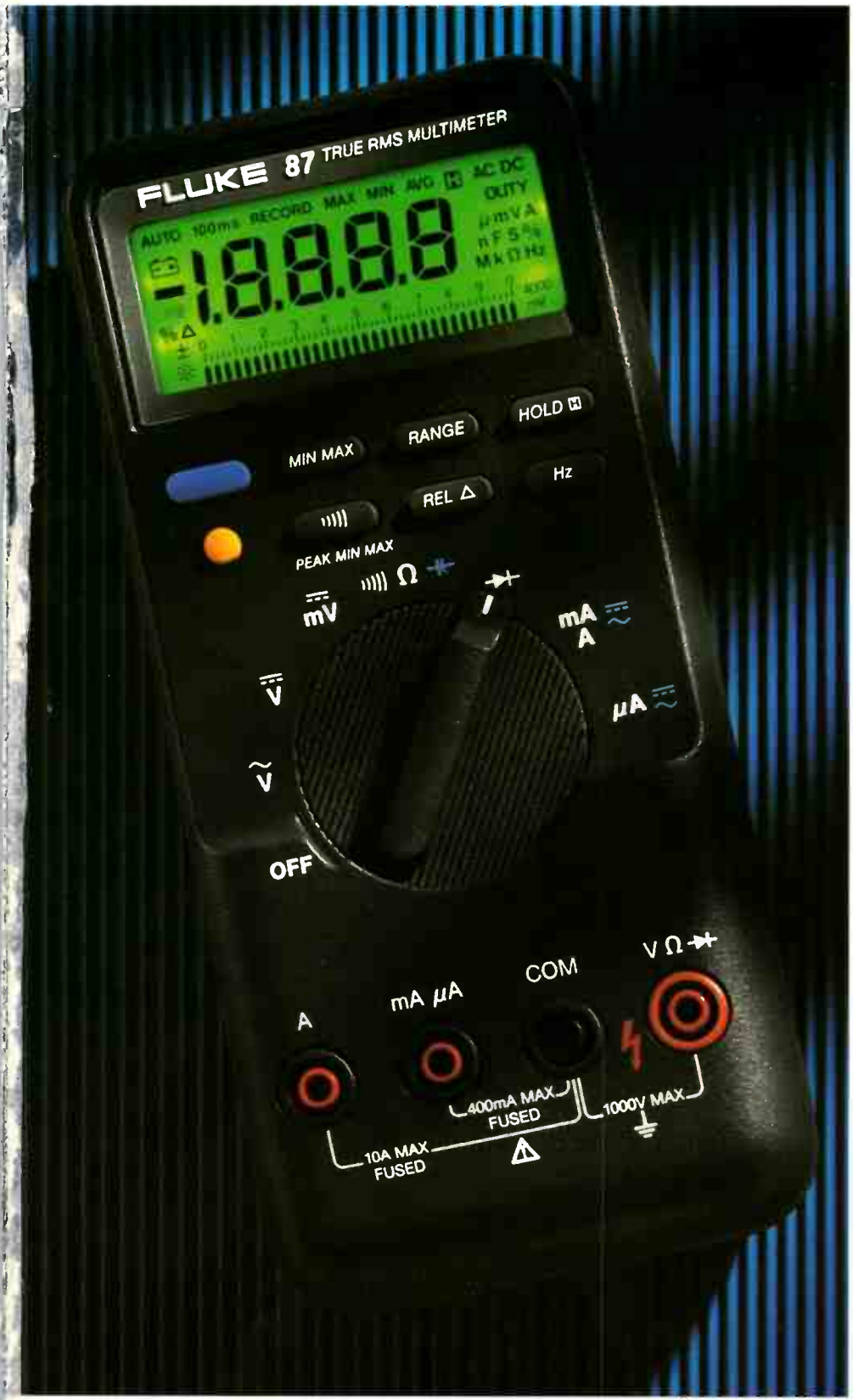


Microwaving the universe

FLUKE

PHILIPS

PHILIPS



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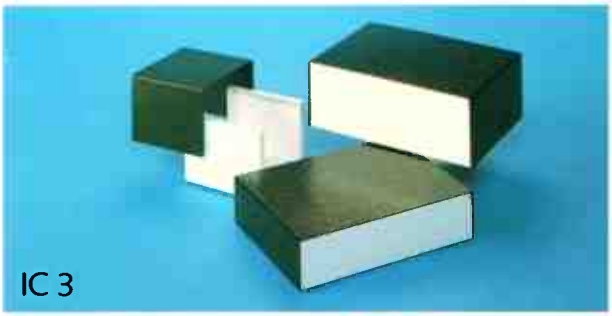

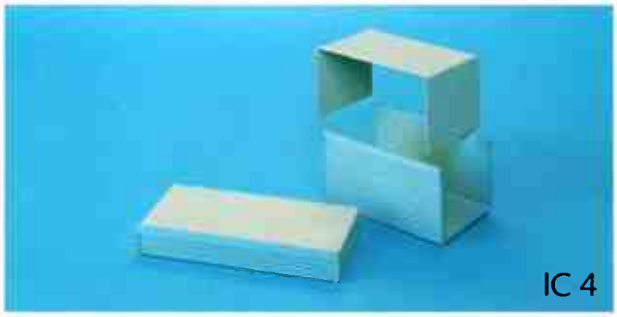

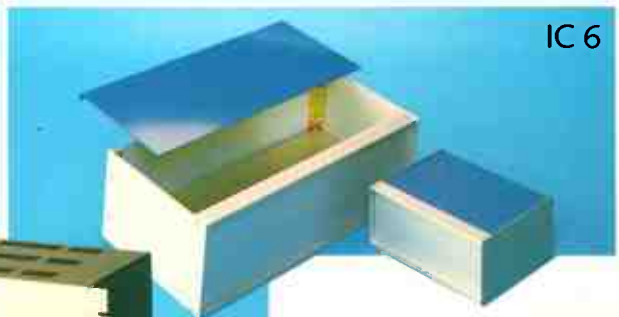

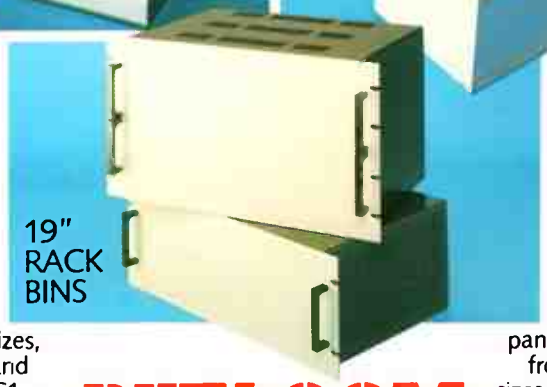

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