September 12 this year was the 22nd anniversary of the official opening of SILLIAC, the first computer at the University of Sydney and one of the first in Australia. SILLIAC, a thermionic valve computer of extraordinary bulk, reached from floor to ceiling and consumed some 35 kilowatts.

Sydney University's first computer

Hailed as being able to do "three months' work in ten minutes", SILLIAC was one of the most advanced computers of its time, being a modified version of the historic ILLIAC machine, designed and built at the University of Illinois.

Today, after 22 years of rapid technological growth, the computing power of SILLIAC can be surpassed by a microprocessor chip weighing less than 30 grams, and computers have become such familiar tools of research that keeping track of their numbers on campus is a major auditing exercise.

With the increasing demand for computing power, the University of Sydney has acquired and discarded two to three generations of computers since SILLIAC.

It now has a major "time-sharing" computer, the CYBER 72, which can simultaneously serve more than 120 terminals located throughout the University. By rapidly switching attention from terminal to terminal, the CYBER gives each user the illusion of having the computer to his or her self.

In addition, there are several other medium-scale computers which service specialised areas such as the Library, Engineering, Computer Science and Administration, as well as dozens of smaller computers with highly specialised applications.

Although the official opening of SILLIAC was not until 1956, its history dates back to the appointment in 1952 of Professor Harry Messel as Head of the School of Physics.

One of his first major undertakings was to establish in 1953 the Nuclear Research Foundation which had, as its first Governor, a well-known Sydney philanthropist, the late Sir Adolph Basser.

When an offer was received from the University of Illinois to supply, at almost no charge, all the circuit diagrams and programs from its historic ILLIAC machine (now on display in a Washington museum) an appeal was launched early in 1954 to raise a sum of £50,000 to build the machine locally.

Soon after the appeal was launched, Sir Adolph Basser personally offered the entire sum to the University, and the computing laboratory was named after him in honour of this donation.

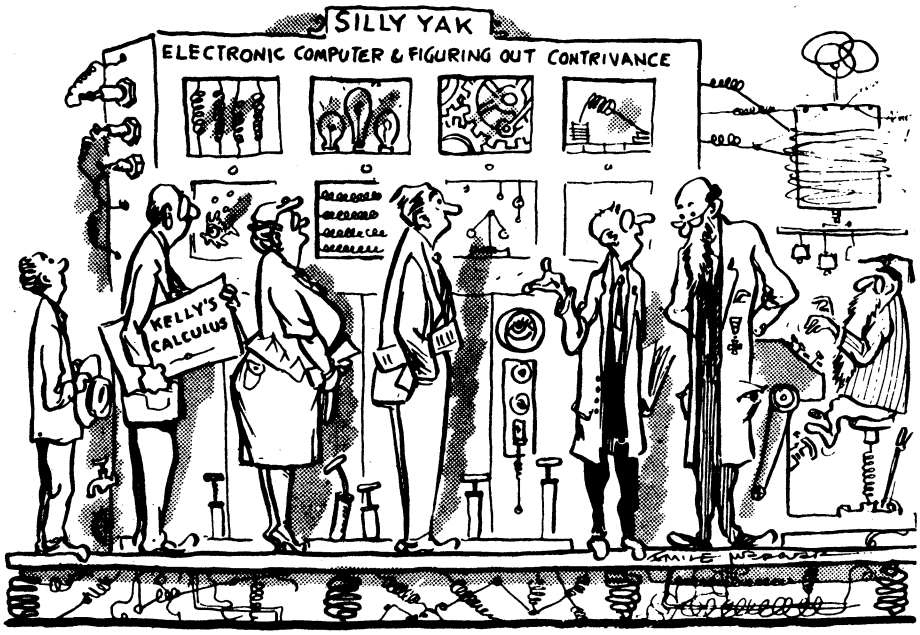
With finance assured, the late Mr Brian Swire was appointed Chief Engineer and spent several months in Illinois studying the prototype machine. He returned in February 1955 to supervise the construction of our own version, and work commenced on the manufacture of the framework, panels, chassis and power supplies.

The electrical chassis were delivered in August 1955 and wiring commenced. Finally, on June 4, 1956, the new computer was able to run a test program.

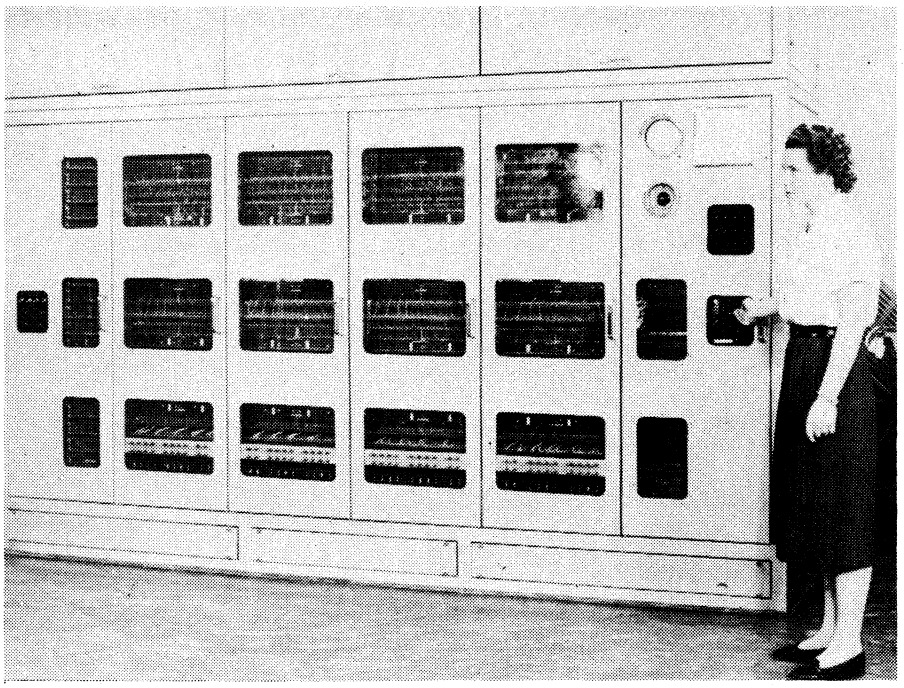
Its first official production run was a scientific calculation lasting 65 minutes which it performed for Dr J. Blatt (now of the University of NSW) on July 5th, 1956.

SILLIAC was a thermionic valve machine with cathode ray tube memory. The mainframe reached from floor to ceiling and consisted of a completely enclosed cabinet about 3.7m long and 0.8m deep.

It had 2800 valves consuming 35

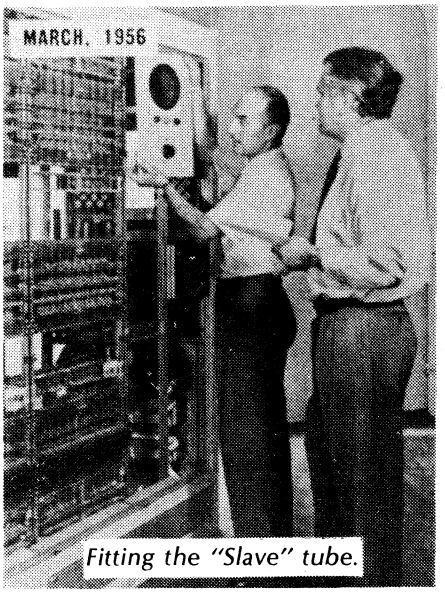


"They want to know how to work out the figures that determine the winning number in a jackpot lottery" — SILLIAC as seen by Sydney Sun newspaper cartoonist Emile Mercier.

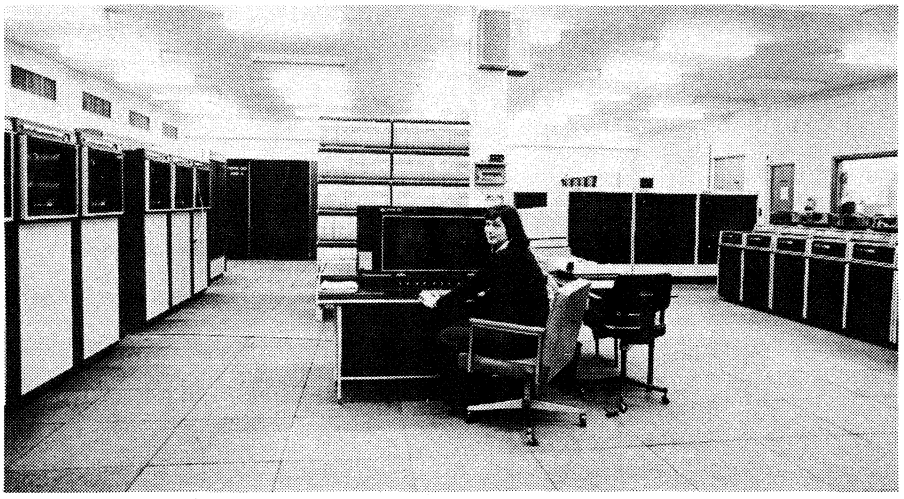


Manufactured by STC, SILLIAC cost around £75,000 and took 2½ years to build. It employed some 13 miles of wire, had 2800 valves, and consumed 35kW.

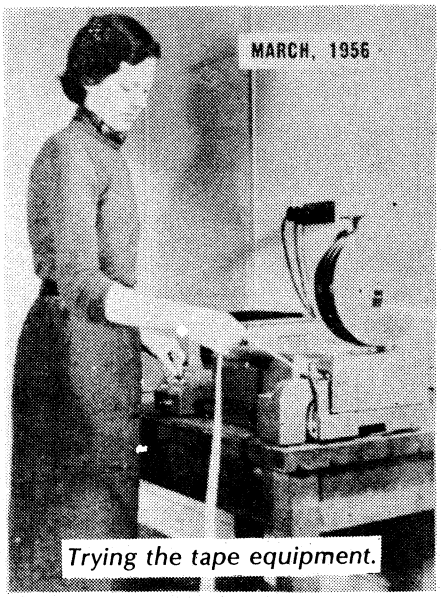
Units arriving.



Fitting the "Slave" tube.



Twenty years later — Sydney University's CYBER 72 "time-sharing" computer is linked to more than 120 terminals throughout the campus.



Trying the tape equipment.

kilowatts, to store, manipulate and change numbers. The whole thing was cooled by circulating chilled air through the cabinet. There were hinged panels at the front and back with perspex windows, through which the contents of the various registers could be seen displayed in neon lights.

On January 3rd, 1956, while SILLIAC was under construction, Dr John M. Bennett was appointed Senior Numerical Analyst and took charge of the programming side of the embryonic Adolph Basser Computing Laboratory.

By 1961, the teaching and research activities of the Laboratory had expanded to the extent that it was made a full department within the School of Physics and on September 4th of that year Dr John Bennett was appointed as Professor of Physics (Electronic Computing). The new department was called the Basser Computing Department.

SILLIAC continued to serve as the University's principal computer until in 1964 the English KDF 9 was installed. After this, there was a gradual shift of workload to the KDF 9 until, in its latter years, apart from running a few programs for sentimental reasons, SILLIAC did little else but act as a magnetic tape controller for the KDF 9 to which it was linked.

An interesting output device connected to SILLIAC was a loudspeaker, intended to assist the operator in determining when the machine had stopped. It also provided endless amusement for the more erudite

Sydney University's first computer

programmers who quickly found that it was possible to generate a series of tuned square waves and play music. The last few weeks of the computer's life were spent entertaining the senior students of Computer Science by playing an enormous variety of popular and other tunes.

On May 17th, 1968, at a moving ceremony, SILLIAC sang the well known Funeral March by Chopin and Handel's Dead March from Saul. The power was turned off by the Vice-Chancellor, Professor Bruce Williams, and thereby ended an era.

The computing power of the Basser Department was greatly enhanced in 1967 when, through the generosity of IBM Australia, an IBM 7040 1401 system was installed.

In 1970 it was decided to make a clear delineation between the academic and service functions of the Basser Computing Department. To this end a sub-department was established known as the University Computing Service and Mr Bob Donnelly was appointed Manager in 1972. This became a separate unit within the School of Physics and was renamed the Basser Computing Centre.

A substantial grant from the Australian Universities Commission enabled the purchasing in 1973 of a new large-scale computer system from Control Data (Australia). A new building was constructed and the computer, a CYBER 72, was installed, without ceremony, in mid-1974. With the change of premises the name University Computing Centre was adopted.

Computer network across the Pacific . . .

The first program was run on the SILLIAC in July 1956, and in those days scientists were delighted to have just one computer to work with. Now, 22 years later, computer scientists at Sydney University are working on ways of "networking"; that is, linking many computers together on a regional basis to share computing power and information.

This has been made possible by the revolution in telecommunications which allows not only pictures and sound, but vast amounts of digital information suitable for input or output to computers, to be relayed around the world via satellite.

Several years ago, the Basser Department of Computer Science at the University joined PACNET (Pan Pacific Educational Computer Network) which carries out networking experiments via the geostationary NASA satellite ATS-1, transmitting to the entire Pacific region (more than 40% of the Earth's surface).

On the roof of the Physics Building (only a short distance from the room which used to house the old SILLIAC machine) two antennae now point skywards to a fixed position where the ATS-1 satellite maintains its orbit 36,000km above Christmas Island in the Central Pacific.

The antennae cost only $200 each to build, and look like ordinary household TV aerials which have sprouted and grown to about 10 times their original size. They are the most dramatic sign that "networking" is going on inside the Physics Building, even though technically they are about the least complex part of the work.

The really complicated work has been going on inside, in the air-conditioned room which was once the home of one of SILLIAC's successors, the IBM 7040, before the operation of the University's main computer was hived off to independence in a separate building. Here, with a mixture of smart-looking "off-the-shelf" computers and "do-it-yourself" boards of chips and switches built within the Department, the hardware has been developed to convert radio signals from the satellite into readable print-outs.

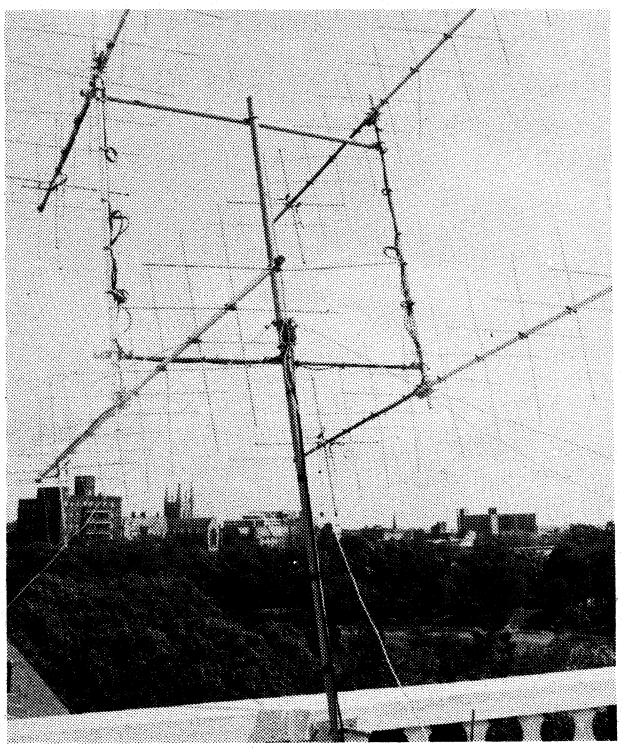
A visitor to the Department is shown a bewildering variety of miniature circuits, modulators and "packet" switching facilities. (A "packet" is a convenient fixed amount of information into which messages can be divided for transmission.) This equipment "wraps up" message or data information and forms a "packet" by appending sender and addressee information.

The transmission speed is 9600 bits (ie about 1000 characters a second). In a talk given at last year's ANZAAS conference in Hobart, Professor John Bennett, of the Computer Science Department in the School of Physics, pointed out that a decade ago, people settled for sending information at Telex rates of 100 bits (say 10 characters) a second, and talked hopefully of 2400 bits a second.

Now 48,000 bits a second is common, and a system is being developed to carry gigabits a second; a gigabit, 10^9 bits, is about the contents of the *Encyclopaedia Britannica*," he said.

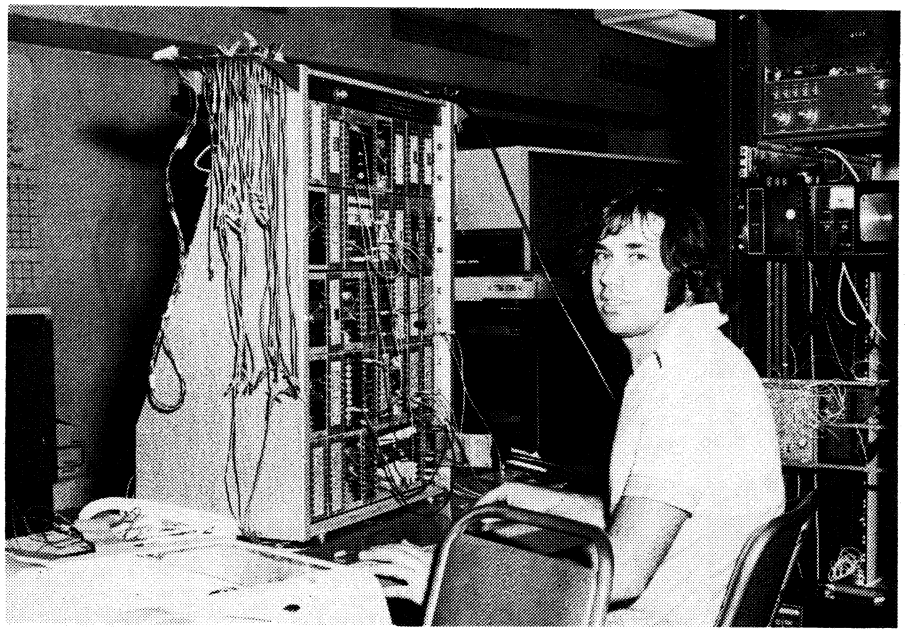
The main purpose of the experiments in the Department of Computer Science, however, is not to maximise the speed of transmission, but to achieve an acceptable speed reliably with low-cost equipment.

Explaining the background to the University's involvement in network-



Vast amounts of information, suitable for input or output to computers, can be relayed around the world via satellite.

Pointing towards geostationary satellite ATS-1 — one of the two antennae used by Sydney University for PACNET. Satellite re-broadcasts with a power of just 40W!



Senior Technical Officer Remo di Giovanni demonstrates the microprocessor-based data processing system. The system converts received radio signals into a form suitable for input to the Digital PDP-11 and Burroughs 1726 computers.

ing, Computer Science Lecturer Dr Ian Parkin said PACNET had originated from a US financed project linking by radio a number of terminals on the campus of the University of Hawaii.

"This project (appropriately named ALOHA) turned out to be a very interesting experiment because it used a new cost-saving idea: single-channel, random access communication," said Dr Parkins.

"Instead of giving a separate channel to each terminal, which would have been quite expensive; it was possible for each terminal to send off its "packet of information and take the chance that it did not collide with another packet from a different terminal.

"If a collision did occur, the packets were sent out again after a suitable delay until they were received and acknowledged.

This "cocktail party' kind of conversation between the terminals and the central computer proved effective. "Given the availability of a suitable satellite it was appropriate to set up PACNET, a similar experiment with terminals communicating around the entire Pacific area," he said.

Realising the significance to Australia of low-cost data communication in scattered communities, both within the country and in the Pacific, Professor John Bennett instituted membership of PACNET several years ago. About 15 months ago, the Department's radio equipment came on air, and since then trial receptions and transmission have been carried out, and continual improvements have been made to the equipment.

Connections from the radio through various microprocessors to the Department's Digital Equipment PDP-11 and Burroughs 1726 computers have been established. Data packets are received daily from Japan via the ATS-1 satellite.

The satellite re-broadcasts with a power of only 40 watts — something like the power of a small light globe. It isn't surprising that the packets are sometimes "corrupted" by noise and interference upon arrival. One of the significant associated research topics involves the use of error-detecting and error-correcting codes to ensure minimal corruption of communications by noise interference.

At the beginning of last year, members of the Department of Computer Science were pleased to find that their radios and aerials could be put to good use even when the satellite was not handling digital information.

The Department was approached by groups wishing to use PEACESAT, a different network of stations operating through the ATS-1 satellite for voice conferencing . . . a rather more sophisticated variation on the "school of the air" in the Australian outback.

PEACESAT uses the satellite on the same frequency as PACNET, but at a different time of the day. It is used for educational, medical and community conferences. Australian educational and medical authorities have expressed interest in using the voice conferencing facilities at the University to discuss common problems with similar authorities throughout the Pacific region. PEACESAT may permit double usage to be made of the radio equipment that has already been assembled for PACNET.

This story courtesy "The Gazette", publication of The University of Sydney.