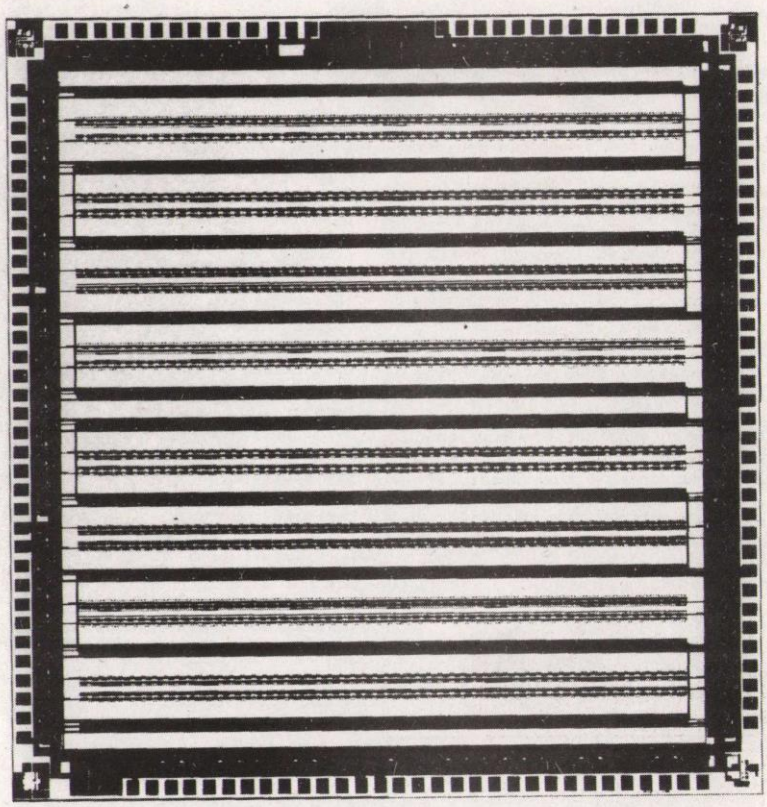
Bulletin
of the Rutherford Appleton Laboratory 18 July 1983 No.11

Designs on the UK 5000

Two years ago, seven organisations joined in the development of a system which will revolutionise the design of complex microcircuits. The system allows the totally automated design of a digital integrated circuit containing up to 5000 gate equivalent circuits. An academic researcher, even with no IC layout skills, will be able to convert his description of a logic circuit into a chip layout within about one week! Since Project UK5000 is close to completion the design details can now be released.

The partners in the project are British Telecom, GEC Ltd, ICL, Ministry of Defence, SERC, STL Ltd and TMC Ltd. They have developed a revolutionary 'gate array', which is a microchip with a predefined pattern of transistors forming logic and latch (storage) elements. The elements are interconnected by two metal layers, using a suite of design programs to implement a user's circuit.



The gate array specially designed for the UK5000 project. The rows of predefined components are clearly visible on the 8mm by 8mm chip. The components are interconnected by two metal layers to implement the user's circuit, which can contain up to 5000 gates. (83FB2846).

Novel Hardware

The gate array has been designed to produce thoroughly reliable and testable circuits. Since no feedback loops are allowed within the logic, the structure provides a simple timing criterion which guarantees hazard-free operation. The elements are arranged in rows which are connected to form a 'scan-path' loop for testing purposes. The layout contains 400 latch cells and 2560 logic cells which, with reasonable allowance for interconnections, can provide up to 5000 gates.

The chip design is based upon 3 micron, two-level metal, oxide isolated CMOS (complementary metal-oxide semiconductor) technology. The collaboration has ensured that this technology will be available from industry in production quantities by early 1984. Present testing is performed using a prototype production line.

Fully Automated Design

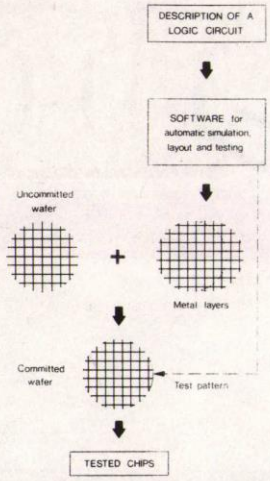
The software suite provides for the automatic design of a general-purpose chip available for the first time to academic researchers. The programs check the user's circuit description for syntax errors and implement a layout on the UK5000 array. The circuit is simulated for various input conditions and the propagation timing delays through the logic are calculated. Automatic placement and routing programs select the best way to place and interconnect the components. Mask patterns are produced for the two metal layers in a format suitable for easy translation into commercial formats such as Calma, Applicon and GAELIC. An automatic program generates a test routine for the logic, taking care to minimise the number of scan-path loops to save test time.

Test Results

The project is well advanced into its testing phase, having so far invested about 35 man-years of effort. In reponse to an invitation to the

(over)

UK 5000 *(cont'd from p1)*



Schematic of the production of tested chips using the UK5000 array (83MB3323)

academic community, five test projects are under way using the UK5000 array. Several circuits are at the design stage and one circuit has been manufactured on the British Telecom prototype production line.

The collaboration is extremely pleased with the progress of the project, which is nearing a successful completion. The participants are convinced that for 5000 gate circuits and beyond, systems must use hazard-free logic and be designed to be testable. The considerable investment in this project is soon to be made available to academic researchers via SERC. Staff at RAL will be giving advice on the UK5000 design methodology, on the use of the software suite and on the procedures for committal and testing.

(We thank John Litt for this latest news on the project).

Further information on Project UK5000 can be obtained from John McLean, Technology Division.

Laser Project on a Platelet

A request recently reached RAL through Central Office for advice on a project being initiated by biologists and medical engineers in Oxford. The project involves a study of blood platelets and how they react and adhere to artificial blood handling materials for use in cardio-vascular devices.

The increasing use of artificial materials for implant surgery in this area has made it increasingly important to understand one of the principle processes leading to difficulties - that of platelet adhesion and premature thrombosis.

For those of you with as little knowledge of platelets as we had a few weeks ago, here is a brief description of these amazing cells. Their main function is to initiate a clotting action in blood which arrests bleeding and causes thromboses. They are disc shaped, about 2 to 3 μm across and less than 1 μm thick. Inside there is a highly complex mixture of molecular structures which give the platelets many functions. The initial phase of clotting results in the projection of fine spikes called 'pseudopodia' and is caused by the reaction of the platelets to a number of possible stimuli - chemical, physical, thermal. It is thought that this trigger reaction can occur on a microsecond time scale and subsequently of course this initiates the clotting process when platelets, blood cells etc start to become entangled on these pseudopodia. Following this physical clotting and triggered by it, the platelets rapidly put out large quantities of certain chemicals which result in rapid coagulation due to chemical processes.

However the picture is complicated by the ability of platelets under weak stimulation to return reversibly to their original state after the first stage, and this process involves re-generation of some internal molecular structures which have been 'used up'.

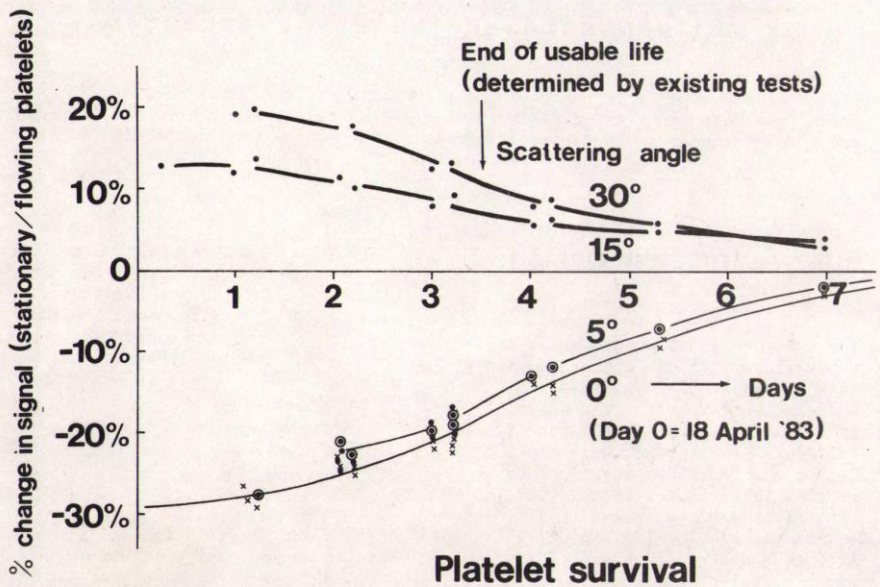
Pilot Experiment

The details of the trigger mechanisms have so far defied the efforts of very many research workers in the field. One of the few possible diagnostics tools which do not affect these very sensitive cells in visual observation. Optical techniques which resolve individual platelets are far from easy in view of the size and transparency of the platelets (phase contrast microscopy required) together with the timescales involved. However other optical techniques can provide valuable information not available by other means. A first simple pilot experiment has been carried out successfully to discover whether an optical technique has value as a non-invasive test of platelet viability. This is of great interest to the blood transfusion centres, who store platelets from donors in platelet packs to be used in major surgery. The platelets in these packs only remain effective for about 3 days on average, although some survive only one day and others are still viable after perhaps five days. No non-invasive monitor is currently available, resulting in many 'good' packs being thrown away while others are not effective when used.

Valuable Technique

The optical test was to project a small laser beam through a 2mm thickness of platelet solution (in the platelet pack) and measure the angular intensity distribution of scattered light for two platelet conditions - stationary and in transverse laminar flow. The platelets are known to change from disc shape to spherical as they age and consequently there is expected to be a change in their scattering properties and in their reaction to a laminar flow. It was found that the 'flow' signal was generally different to the 'stationary' signal by an amount which reduced to zero as the platelets age. Hence the difference between the signals of stationary and flowing platelets can be used as a monitor on platelet viability. The illustration shows the results of an experimental run on a platelet pack. These measurements were compared with standard tests (requiring a sample to be withdrawn from the pack) which showed this pack to have a life of 3 to 4 days. The large fall after this time of our difference signal has shown that the technique is a potentially valuable one in this medical application. It is hoped that an engineered version of our test device will before too long provide a permanent on-line monitor for the dozens of platelet packs passing through the Transfusion Centre every day.

Ian Ross



Platelet survival

FIVE AWAY

John Delury

John Delury, Head of Geophysics and Radio Division until his retirement on Wednesday 29 June, held the unique distinction of working for the Rutherford Laboratory, the Appleton Laboratory and finally the Rutherford Appleton Laboratory. "I don't know of any other cases", said Geoff Manning at a ceremony held to mark the occasion of John's departure.

John's career spanned 37 years all of it in Public Service. He joined the Ministry of Supply in 1946 as an engineering apprentice, and from Woolwich Poly, proceeded to UMIST for postgraduate studies. In two year stints he worked at the Armament Research Establishment at Fort Hailstead and Aldermaston, did his National Service with REME, joined AWRE in 1956, AERE in 1958 and in 1960 became involved with Nimrod, first in the Services Group and then as Head of Installations and Operations in the Nimrod Experimental Halls.

The Ministry of Overseas Development then claimed him for 3 years, during which time he was Head of Plant and Equipment Division of the Ministry of Works and Housing Water Supplies in Ghana.

Back at the Rutherford Lab in 1969 he was involved in the Nimbus E project, where he got the taste for space which led him to join the Appleton Lab in 1973. With the merger of the two Labs, he returned to Chilton as Head of G & R Division, one of his major roles being that of overseeing balloon and rocket work - the Stabilised Balloon Platform, with its accurate pointing control, being one of his major successes.

John has always been something of a sportsman, having (so it is reported) been a professional footballer and a table tennis player of no mean repute. His love of the moment is, however, golf to which he brings some interesting techniques developed on the greens of Ghana, (which are more aptly described as browns).

Geoff Manning presents Mrs Delury with a bouquet, while John displays his clock.

What is he going to do now he's retired? He declares his future ambitions are to get his wife's golfing handicap down a couple of strokes, and continue his task of running "Delury Towers", his vast mansion in Pangbourne, of which stories are legion, mostly apocryphal - and highly entertaining.

Presenting John with the traditional workshop made gift, in this case a magnificent wall clock, also a camera, case and lens, Geoff Manning spoke on behalf of all when he wished John a happy and productive retirement "I am certain we shall see him again, and will welcome him at all times," he said. "Thank you for all the service you have given to the Lab, for being a nice guy and for maintaining a balance in all you have done".

John reminisced briefly of his experiences in the service of the Lab, of people and of places. "On behalf of Mavis and myself", he concluded "I thank you for these wonderful mementos. In the years ahead we shall think kindly of you all and remember the individuals of RAL who made up the teams whose comradeship we have so enjoyed".

Tom (right) and Peter admire the daisy grubber.

Tom Clements

A packed R12 Conference room was the venue for the presentation ceremony arranged by Tom Clement's colleagues, to wish him well in his retirement.

Another of the Nimrod Naval contingent Tom joined the Lab in 1961, was involved in the commisioning of the power supplies and then became a valued member of the Operations Group. At the close of Nimrod he was transferred to electronics group. This, as Peter Wilde pointed out in his presentation speech, did seem a strange miss match; Tom's background seemed all wrong. But, it was a great success, for which the group had blessed it's luck.

"Toms's characteristics are care, willingness and an open friendliness" said Peter. "We have all enjoyed your company - we hope you've enjoyed ours". He then presented Tom with the traditional "Get well card", a daisy grubber (which caused intense interest amongst the spectators) and a DIY garden seat. "Sit in that and think kindly of us" Peter concluded.

"It has been my pleasure to have been with so many good people", replied Tom, "I have enjoyed all the years at RAL. Thank you all for coming to say Goodbye, and for the gifts. I wish you all well."

Bill Higgins

Despite his request for a quiet farewell, Bill Higgins could not be allowed to leave without some ceremony, and his many friends and colleagues made sure it happened.

Roy Tolcher, Head of EBWD, made the presentation on behalf of all Bill's friends and colleagues. "Bill" he said, "is one of those quiet types who beavers away in the background, nevertheless carrying out a function very valuable to the Laboratory."

Bill's career at the Lab began in 1961 as a skilled craftsman, but he soon

Bill *(ontinued)*

became a temporary Clerical Officer and eventually and for many years, worked for the Nimrod Engineering Group on records and spares. In 1978, on the demise of Nimrod, he joined EBW on a temporary basis, but his performance was such that he soon became a permanent member, his particular skill being the computerisation of record systems. His work in this field will stand the division in good stead for many years to come.

Interestingly, Bill is also an ex-Navy man. (It is rumoured that in the early days of Nimrod the naval presence resulted in the mast of HMS Nimrod being saluted each morning!) This was reflected in the card, specially prepared by Peter Bradley and Richard Harrington, presented to Bill together with a watch, tree pruner and garden spray by Roy Tolcher. The card depicts Bill playing naval war-games on his computer - a figment of fertile imaginations. He never had the time.

Roy thanked Bill for all the good work he had done for the Lab, and on behalf of all, wished him and his wife a long and happy retirement.

"Thank you all very much," said Bill in reply, "I'm pleased and yet sorry to be going. Thank you for your kind thoughts and the wonderful gifts. Good luck to you all."

Carole and Sally

No less missed than these stalwarts of the Lab, will be two of our younger and comelier colleagues, Carole Rowland of the typing centre and Sally Gill of Bill Paying, who said farewell on 30 June.

Carole, to whom the editor of this rag will always be grateful for copy accurately typed, (usually at very short notice) is leaving to take up motherhood. Sally is getting married and leaving the area after "being a good colleague for four years".

All their friends and colleagues at RAL wish them every happiness for the future.

'100' Club

The draw for June took place on 6 June. The £125 prize was won by Mr R Jones, R3 on ticket No. 72. Mr R Hopes, R65 with ticket No. 71 won the £25 prize.

The draw was made by the CSSC representative Heather Thompson.

Golfers Victorious

For the fourth year running the RAL 'B' team, captained by Geoff Manning, won the Sir Brian Flowers Trophy at SERC's annual Golf Tournament.

Held on Friday 24 June at the North Wilts Golf Club, the 36 hole competition was fought out between eight teams; two from Daresbury, two from Central Office, one from the Royal Observatory Edinburgh and three from the Laboratory.

Though overcast, the day was at least dry, and, according to the participants, this pleasant downland course played well to par (72). Rain the previous day made placing the ball on the green tricky, but some very good scores were made, and the concensus of opinion was that it had been an enjoyable day's golf.

Assisting their captain to victory were Norman Beadle, Joe Paxton, Ken Quinton, Rob Witty and Ken Louch. Ken Louch also won the RGO Trophy for the best 36 hole score off handicap. (Plans are afoot to send him abroad somewhere next year).

John Delury's 'A' team repeated their second placing, and the Central Office 'A' team led by Mick Jeffries won third place. The Chairman's Trophy for the best gross score over 36 holes was won by Doug House, with a score of 170 (making things a bit complicated for him when later in the evening he had to present himself with the Trophy).

Congratulations are also due to Derek McCall, Central Office 'A' for the best morning round of 37 points and George Spalding, RAL 'C' - his round of 36 points was the best of the afternoon.

The 'Two's Sweep' for those making a hole in two was shared between Bill Pitman and Jim Sadlier of Central Office, and John Delury, Ken Louch and Doug House, all of RAL. Brenda Owen, Daresbury, won a special silver goblet for her courage and fortitude in putting up with so many men for a whole day. We hope she is only the first in a long line of lady competitors.

Originally.the ROE team were 1 player short so Bill Cormack's son Kevin was invited to make up the number. Apparently undetered he went ahead and returned the best points score for the day of 79. Being a guest he could not hold the RGO Trophy, so Kevin was awarded a special prize of a dozen golf balls for his efforts.

Presenting the Trophies and individual prizes after dinner, Doug House expressed his pleasure that the day's golf had been so enjoyable - due in no small part to the organisation of Roy Bell and Ken Louch, also the very much appreciated assistance of Albert Taylor and Christine Gregory who were starters and score checkers. "It has been nice to have you all here", he said, "We look forward to seeing you next year".

Thanks

Peter White would like to thank all his friends at RAL for their help and sympathy over the past months, also for the generous donation to "Action Research for the Crippled Child".

Film Badge Notice

It is Period 8 Colour strip PURPLE. Please change your film promptly and return all old ones.

Bulletin

Editor: Jean Banford
Building R20
Rutherford Appleton Laboratory
Chilton, Didcot, Oxon OX11 0QX
Abingdon (0235) 21900 ext 5484

Deadline for insertions: