7th Issue

ORBIT

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The Journal of the Rutherford High Energy Laboratory

The Coming of ORION

The ORION computer is scheduled to arrive at the Rutherford Laboratory in February to be installed in Building R1. Mr. Walkinshaw fills in some of the background history of the computer.

In 1958, it was realized in many quarters that the computing resources of the country were quite inadequate and that urgent measures were required to improve the situation. It was also clear that the Rutherford Laboratory would require large scale computing capacity, especially in the field of bubble chamber data reduction, by 1962. The policy of continuing to use the Atomic Energy Authority's computers was discussed at great length during 1959 but eventually it became evident that no guarantee could be given that this would be possible.

Towards the end of 1959 a symposium was held at the Rutherford Laboratory, at which about forty visitors from the Universities discussed the future needs of the research programme. Following this meeting, a case for having a computer was presented to the Physics Committee of the National Institute in January, 1960, and the decision to ask for an ORION was endorsed. Treasury approval for the project, at a cost of £400,000, was given a few weeks later.

In presenting the case for ORION it was specifically stated that we were certain that we would wish to have access to a computer of the ATLAS class at some future date. Indeed, at that time, it seemed likely that A.E.R.E. would install an ATLAS on the Harwell site. Subsequently, of course, due to the competing demands for increased computing facilities by the Universities and other organizations it was decided by the Minister for Science, to install an ATLAS here under the administration of the National Institute. The ATLAS is much more powerful than ORION and will provide a national computing service with the Rutherford Laboratory as one of its many customers.

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THE COMING OF ORION - (cont'd)

As soon as ORION comes into operation at the Rutherford Laboratory, the computing load is sufficient to fill one shift and by the end of this year we hope to open up a second shift. The greatest demand will come from bubble chamber data reduction. Computing programmes, developed here, are already extensively used by University Groups in analysing data from bubble chamber pictures taken at CERN. Towards the end of this year it is hoped to feed measured data directly into the computer through a Direct Input line. The measuring machine, the H.P.D. (Hough Powell Device) is already under construction by the Bubble Chamber Group. This is an exciting new field of computer application and ORION, with its time-sharing facility, is well adapted to experimentation in this field.

The bulk of the remainder of our computing load comes from dynamical studies on NIMROD, beam design, the Chemists's cyclotron and on linear accelerators. Dispersion theory calculations on π-π interactions are also being done in collaboration with University theorists many of whom spend time at the Rutherford Laboratory making use of our computer facilities.

The ORION Computer System

D A Harragan

When the topic of conversation is computers the names that are mentioned most frequently are the Ferranti Atlas, the IBM Stretch or that well-known number the IBM 7090. These computers are large, fast, and expensive. Although ORION does not qualify for membership of this over £1,000,000 club it is nevertheless, even by today's standards, a large and powerful computer.

The Rutherford Laboratory ORION will be the first of fifteen to be installed in this country, most of the others being scheduled for commercial applications. The design and capacity are such that the computer can be used equally well for scientific computing and for data processing.

ORION is fully transistorised and much of the circuitry is made up of what are called "neuron" packages. These are printed circuits which can be removed and replaced with ease, aiding maintenance and fault finding. The internal arithmetic is carried out in binary and each item of data is represented by a work of 48 binary digits. One word can contain a fixed-point number up to 140737488355327, a floating-point number up to 10^{38} or eight 6-bit alpha-numerical characters. A 49th bit can be used for parity checking whenever the word is used.

The ORION is truly a computing system. Three features that give this versatility are - a fast general-purpose central computer; facility to attach a large number of peripheral devices, and a time-sharing system which allows several programs to run concurrently.

The Central Computer

The Central computer has a large two-level store; that is to say the internal storage consists of an immediate-access working store and a relatively slow but cheap backing store. The working store is made up of 16,384 words in magnetic cores with a cycle time of 12 micro-seconds. The backing store consists of two magnetic drums each holding a total of 16,383 words (128 tracks each containing 128 words) which revolve at 2500 r.p.m.

The instruction code is extensive and orders can be of the 3-address of 2-address form, which allow two numbers to be added, subtracted or otherwise combined and the result written in a word of core store in one instruction. Operations can be in fixed or floating point, and instructions can be modified and addresses replaced before execution.

Although this basic instruction language is sophisticated and powerful, users of the Rutherford Laboratory ORION will not need to use this language in writing their programs. Most people concerned will be familiar with two of the autocode languages in current use, Mercury Autocode and IBM Fortran. Both of these compilers will be provided and many existing programs written in Autocode will be able to go on ORION with little change. The ORION-Mercury autocode is an improved version containing additional features and as a consequence it in fact takes longer to compile an autocode-written program on ORION than on Mercury but a

faster version should be available at a later date.

The Theoretical Physics Group is engaged in producing the Fortran compiler to be in use before the end of 1963. During the early days of ORION considerable time will be spent in completing this Fortran compiler to enable bubble-chamber data reduction programs to run. This compiler will be enlarged steadily in scope and the speed of compilation increased to give highly efficient programs.

Like all computers, ORION has a control desk or console. It has a display of lights indicating, in the form of a route map, the instruction being obeyed. There are also sets of switches and lights showing the contents of certain registers, and an electric typewriter (flexowriter) for communicating with the central computer. This flexowriter will type out messages from the computer and can be used by the operator to make requests or commands as required.

Peripheral Devices

A large number of different peripheral devices can be attached to the computer. The devices fitted to our ORION are paper tape readers, tele-type punches, magnetic tape units, a line printer, and an on-line direct data link to an automatic film reader. Other on-line devices could be added. In fact Orion is capable of handling 125 peripheral units. At present no punched cards equipment is to be attached but if Orion runs successfully no doubt devices could be added.

The paper tape input consists of one fast (1000 characters/second), and two slow (300 characters/second) readers. Both types can read 5-hole or 7-hole paper tape. Use of 7-hole tape is preferred since it gives additional symbols and also a parity check. Paper tape output uses two tele-type punches operating at 110 characters/second, and the tapes can be printed off-line on one of four flexowriters that will be available.

Six magnetic tape units and two control units will be attached to ORION. These provide a fast mode of data input and output, 90,000 characters being read or written each second. Writing and reading is fully checked, and words are usually written or read in blocks, for speed of operation. The line printer can print up to 120 characters per line at a rate of 600 lines per minute; spacing and paper throw can be programmed.

Time Sharing

Many computers are capable of operating two or more peripheral devices at the same time. The peripherals are usually called by the same program and often the central computer is idle while printing, reading and/or punching takes place. ORION, however, employs time-sharing in its truer sense and a number of programs can share the machine at any time, enabling the computer to use the time occupied by slow input and output operations. One program can use the central unit while another is using a peripheral device. Switching of programs is achieved by means of moniter and organisation programs permanently stored in the computer. These master programs make it impossible for one job to interfere with another and provide such things as reservations, lock-outs, priority processing, and time accounting. It is important to realise that the switching operations occur many times a second; the monitor program is in frequent touch with the operator via the flexowriter, and full account is kept of the time for which each program occupies the central computer.

In addition to the ORION computer room itself, there will be a tape editing room containing teleprinters, paper tape punches, flexowriters and storage equipment. Magnetic tapes will be stored in the air conditioned computer room. Initially Orion will be operated for one shift for a first few months after its installation. Before long, however, it will be necessary to work two or more shifts in order that Orion can play its full part in the work of the Rutherford Laboratory.

Perhaps one day, in the not too distant future, it may be coupled directly to Nimrod and provide an interesting prospect in the field of 'on-line' running. Will Nimrod obey Orion or will it be the other way about?

ORION (or Oarion) figures in Greek mythology as a mighty hunter of great strength, the son of Hyriens and Poseidon. He was the beloved of Eos, the dawn goddess, who carried him off to Delos but the jealous Artemis slew him with her arrows (Odyssey v. 121).

After his death he was changed into the constellation of stars which bears his name. The constellation took the form of a warrior wearing a girdle of three stars and a lions skin, carrying a club and a sword. When it rose early it was a sign of summer; when late of winter and stormy weather.

Orion, 1,200 light years away, is one of the most conspicuous constellations containing many bright stars. Of these Betelgeuse, distinguished by its yellowish-red colour, was the first star for which the apparent diameter was measured by the Michelson's interferometer method in 1920.

On Courses

T R Walsh

I was never one for beating my head against a brick wall so, having been given the job of organising some lectures, I decided to find out first what lectures people wanted and then what people were willing to lecture about.

The first inquiry produced many requests for a course on accelerators from people whose professions allowed them to admit ignorance on that subject, and it so happened that there were a number of people prepared to talk about accelerators. This happy coincidence issued in a lecture course called 'Fundamentals of Accelerators' which has had a successful career terminating on the 15th January. Fate decreed that I should myself give the first lecture of the series. On entering the Conference Room I found it full and my heart expanded with gratitude towards the audience proving the theory that lectures were needed. This theory had been presented by a persuasive and articulate member of the Steering Committee who is keen on attending lectures. Later, attendances became even larger, though they fell again before the end. Experience of W.E.A. lectures had warned me that this would probably happen so I was not too disappointed.

The other line of inquiry, what were people willing to lecture about, gave birth to what is now known as the Thursday Evening Lecture Series. I have a hope that one day one of the Thursday lectures will come out with something really outrageous like a flat-earth theory or a proof that Newton's 'Principia' was written by Francis Bacon, but possibly some of the things said have been outrageous enough for some people. Generally the idea is to give a talking outlet for people with special interests. Conversely the audience must have wide interests: you need wide interests to be interested in a lot of other people's special interests. Students of lecturers 'technique' are also catered for, witness the riposte - "Would you please re-phrase your question in such a way that it is easy for me to answer it".

One of the most interesting issues raised by this work is whether to have the lectures inside or outside working hours. To some, this is a matter of indifference but there are two clear schools of thought. The "outsiders" are characterised by a tendency to feel superior to the others while the "insiders" tend to feel surprised at the existence of the outsiders. The difficulty is that both sides have excellent arguments of a somewhat personal nature to back their case. One could not refute them without meddling in their private affairs, not that I want to because I sympathise with both. Besides, insiders or outsiders they are all audiences and lecturers.

The strangest aspect of this dispute is guilt about wasting time. Some feel they are wasting time by attending lectures, some feel that others feel they are wasting time. These people are, of course, outsiders though there are many who are outsiders for different reasons. I say this is strange because, in one way or another, these lectures are concerned with the furtherance of knowledge. Anyone who thinks that the furtherance of knowledge is a waste of time must surely feel a little uncomfortable in a Laboratory whose avowed primary aim is the furtherance of knowledge.

Dr. Pickavance will give a lecture in the Thursday Evening Lecture Series

on 31st January, at 5.30 p.m. in the No. 1 Conference Room.

The lecture is entitled 'Manpower, Money and Politics in High Energy Physics'.

John Wilkins Memorial Fund

It is proposed that a plaque in memory of John Wilkins shall be placed in a suitable position in the Laboratory - perhaps in the main entrance hall or in the Lecture Theatre.

It is hoped that it will also be possible to award annual prizes to the most promising Scientific Assistant and Apprentice. If you have not yet made a contribution to the Fund and wish to do so, please send money or cheque to Mr. Woodall, Building R.1.

Tree Planting Ceremony

Lord Bridges, Chairman of the Governing Body of the NIRNS, visited the Laboratory on Thursday, December 20th to take the Chair at a meeting of the Institute's National Whitley Council. In spite of the appalling weather conditions, torrential rain was falling, Lord Bridges and the Director used the occasion of the visit to plant a maple tree on the mound. Lord Bridges, a keen gardener, was not satisfied with a symbolic spading of earth and both he and the Director well and truly planted the trees. An entourage of Official and Staff Side representatives of the Whitley Council, who hurriedly provided themselves with a varied assortment of clothing and footwear as protection against the elements, watched the planting.

EDITORIAL

The Advisory Council on Scientific Policy published its Annual Report for 1961-62 on 14th January. The Minister for Science invited the Council to consider the question of international scientific activities and to advise on the issues of policy to which they give rise. Here are some of the conclusions given in the Report -

"The development of international co-operation in science is, in principle, desirable. But the extent to which organised international co-operation is necessary, must depend upon the circumstances of each case ... While international collaborative schemes in which the United Kingdom has so far participated (C.E.R.N., the Halden reactor project; the Dragon reactor project and the European Space Research Organisation which is still in the formative stage) have, for the most part, produced stimulating and worthwhile results, it is not possible to claim that any and every international collaborative arrangement necessarily has merit simply because it is international. Each scheme needs to be considered on its scientific merits.

"Domestic scientific efforts may have to be limited if costly centralised international scientific projects increase greatly in number. The maintenance of reasonable balance between national and centralised international activities, and a close relationship between them, is, in the Council's view, of great importance ... It should be noted that proper use of very advanced apparatus provided internationally, is not possible by member countries without a substantial measure of activity within the countries themselves. Thus the existence of CERN does not in any way obviate the need for a national effort in nuclear physics, and may indeed stimulate its expansion. In our view it is important to ensure that national research teams from universities can engage in the very advanced fields of research which are opened up by the provision of international facilities such as those at CERN.

"We believe that it is mistaken to suppose that it is preferable to resort to international activities whenever possible, simply because it is politically desirable to extend the area of international co-operation. As the Minister for Science suggested to us, it should not be supposed that international co-operation is a substitute for national excellence."

Science now absorbs a large proportion of the nation's resources and the allocation of money and effort cannot help but be a political as well as a scientific decision. The Council, considering mainly co-operation in European projects (the comment concerning CERN and our position with regard to CERN is particularly gratifying) lays considerable emphasis on the need for the scientific justification of each project. This seems an obvious and healthy warning.

Possibly the Council did not speculate on the possibility of international collaboration breaching the iron curtain. Is this a case where political implications might be the over-riding factor? In a recent Editorial we commented 'If nations were to pool resources and make an accelerator in the 1000 GeV range a world venture, more than a purely scientific purpose would be served .... the scientific justification for such an enterprise is at least debatable. Perhaps if the scientific motive were bolstered by the motive of international co-operation it would be well worth while.'

Another area of scientific effort which cries aloud for international co-operation is the 'space race'. Sir John Cockcroft said in his address to the British Association last year that 'sending a man to the moon will have very little scientific value'. Yet the two Great Powers are putting a ludicrous proportion of their scientific expenditure to this end. President Kennedy recently announced with pride that 40% of America's research and development was devoted to space and related activities. This is an obvious case where international collaboration regardless of the scientific merit of the project would be of enormous benefit in avoiding the panic politics of the present race and the fantastically expensive duplication of scientific effort.

Each case, as the Council said, must be considered separately and generally the scientific merit should be the deciding factor. But the extent to which politics will influence the decision, certainly with regard to inter-power-block projects, could be very great.

Letters to the Editor

Letters may be addressed to 'The Editor, ORBIT, Building R.1'. Pseudonyms are accepted provided the authors name is known to the Editor.

Sir,

I must thank 'Humanist' for his kind comments on my article 'Assisting the Said Incumbent' which he makes in his interesting letter. In so far as the statement to which 'Humanist' takes exception was made in the context of an article dealing with sparetime activities and is an expression of personal belief it was not really intended to serve as the basis for a disputation! To examine critically the relationship between Christianity and Science employing careful definitions of the terms used would result in a very lengthy article. Space would not allow nor, possibly, would 'ORBIT' be the most obvious publication. After the large dose of metaphysics which the 'ORBIT' readers have sustained, perhaps we are ready for something less indigestible like lasers or general relativity! Be that as it may there are aspects

(cont'd. overleaf)

of 'Humanists's' letter which call for comment from the Christian viewpoint.

'Humanist's' identification of the Christian religion almost completely with the supernatural (whatever is meant by that term) is to ignore the fact that the Christian religion is as much concerned with the material as it is with the spiritual. Any analysis in terms of only one or the other is essentially unbalanced and one-sided. It is the relation between the two sides which form the basis for much of the theolcgy of the Christian Faith. Thus in the formulation of one of the earliest central Christian doctrines - that concerning the nature of the persen of Christ - two approaches are needed. The one considers the evidence for the human or material side and the other the evidence for the divine, spiritual, or supernatural side. The fact that the result seems to be best expressed in a duality in which the complete attributes of the humanity and the divinity are seen as a unity in the person of Christ ought to be less dismaying to a scientist who is familiar with say, the duality which appeared to exist between the corpuscular and the wave nature of light. Most of the early inconsistancies (heresies) in theology arose when one side divine or human was emphasised to the exclusion of the other.

It is just this one-sided emphasis which 'Humanist' shows in his letter. In attempting to define Christianity solely in supernatural terms and Science in material terms he has effectively precluded if not a synthesis at least a paralleling between the two. Certainly many theologians would have reservations in accepting the somewhat one-sided definition of the Christian Faith given by 'Humanist'. I cannot speak for the Physicist but I would have thought that the pursuit of facts could not be defined in entirely materialistic terms - would not the concept of creative thought or intuition (which 'Humanist' does not treat) have some relation to the background of experiment, logical deduction, and formal learning? Does Physics end with A + B = C?

Christian theology, which is a continual process, must take account of man's place in the Universe. Discoveries which Science may make concerning the nature of the universe must therefore be of immediate relevance to the theologian in his task of interpretation and synthesis. Certainly the new concepts which have revolutionised thinking in the field of Physics appear to be leading to a deeper understanding of some of the early Christian premises formulated in pre-critical language during the early centuries of the Christian Church.

It is in this sense rather than that of 'Humanist' that I spoke of the immense common ground between Scientific discovery of fact and the Christian search for Truth.

Ken Smith

Sir,

I agree partly with 'Humanist' in your November issue but I think he has missed some aspects of Christianity which are important.

Firstly, revelation can be experimental. God does not issue a nicely laid out "Statement of Revealed Truth - circulation to all heads of churches". Much of the revelation in the Bible is through men seeing God do things. And to see Him act they had to obey or, in other words, they had to act on what they already knew. It is a continuous process of acting on what you know so that you discover more about God by what happens. For instance, the children of Israel discovered God's care for them in His provision of food by going on the journey through the wilderness, and the seriousness of sin through the death of a group who rebelled.

A further example of the experimental method is the one quoted by 'Humanist' in an attempt to demonstrate his point! Judging by the new Testament records, the Trinity was not revealed dogmatically but must have grown up in an empirical manner, for it is nowhere explicitly stated. What appears to have happened is that the early Christians, being Jews, knew that there was only one God, then realised that Jesus must be God; heard Him talk of His father in heaven; then had the experience of a powerful divine personality working within them. These things could only be summarised in what we know today as the doctrine of the Trinity. It was later history which caused it to be defined dogmatically.

The idea of deliberate experiment in science is, as you can see, absent from the above examples. It is, however, present in the Bible in its invitations to 'prove' God to see if He will do what He says. To one like myself who has come to faith in Jesus from a position of scepticism the whole thing is rather like this - a kind of gigantic experiment. One made a step in the dark and one looked to see what happened.

The second aspect which was missed is the freedom to question what has already been formulated; one which is very apparent in the Protestant churches, being partly responsible for their divisions. In fact it was the burning issue at the Reformation. Men like Luther discovered in their own experience and the Bible, ideas which the official church was apparently denying and they refused to recant because they could not give up what they saw to be true.

I hope I have succeeded in pointing out some things which science and Christianity have in common and which, for me, unite them into the larger picture of the relationship between God, his world and men.

Peter Jones

Sir,

I feel compelled to enlarge on the sentence "An average English workman produces less than half as much as an American" contained in the article on "The University" in your November issue.

Whilst the American workman is supplied with every kind of technical and mechanical device which will; (a) overcome lack of personal skill, (b) produce standard parts to mate with simplified design, (c) produce at a high rate using very little effort or skill, the British have a much

higher level of craftsmanship, spread over wider fields of skill than his American counterpart - indeed, his skill and efforts are usually the only contributing factors by which production is achieved.

The average American workman faced with the antiquated equipment, management and methods prevalent in some sections of British industry would be unable to even start producing, but in the case where American business has introduced American methods and combines this with English craftsmanship, the results are unequalled in quality, quantity and price. To name but a few American companies who have built and produce in this country, Goodyear, General Motors, Massey-Fergusson, Hoover, Ford Cincinatti m/Tools, Kearney and Trecker, Almo, The National Machinery Co., Singer, Rockwell, Vauxhall etc., they obviously do not share these views, since by no stretch of the imagination could these tycoon-industrialists be termed charitable institutions for the benefit of fuddy-duddy half-speed English Workmer. Hoovers, incidently have actually outgrown the parent American firm, and it is now a case of the "tail wagging the dog".

It would be more accurate to criticise those managerial functionaries who fail to utilise the best skilled labour in the world through unimaginative production methods or antiquated attitudes in personal relations and communication. Should Dr. Bowden care to visit some of the thriving plants, (British and American owned), in his own locality of Trafford Park of Broadheath he would be well rewarded.

This deplorable trend from both external and internal sources in disparaging things British has long since become tedious and a bore.

"Ad Rem"

Sir,

In your last issue I was shaken to find that your contributor Peter Jones boldly stated that Nimrod acquired its name from mythology.

Let me quote N.I.R.N.S. own hand-outs:

"Nimrod - a mighty one in the earth".
Genesis, Chapter 10, verse 8 - 12.

Correctional regards,

Jim Reader

Outside Hours

Some reflections on

The Stockmarket Game

Taurus

It is remarkable easy to buy shares on the Stock Exchange. You merely phone your stockbroker and say "Buy", and that is that, at least until the bill arrives several weeks later. Meanwhile there is plenty of time to review your financial position and, each morning over breakfast, to see how your purchase is faring by turning to the back pages of the daily paper. This must be done with great sang froid to avoid embarassing questions from your wife since, of course, the price always goes down to begin with. If you wish to avoid this early morning shock, when your resistance is low in any case, it is better to prepare for the worst by listening the night before to the London Stock Market Closing Report By Exchange Telegraph which is broadcast on the Home Service at 6.27 p.m. (Midland) and 6.57 p.m. (London). (What different ways of life these two times suggest: could unemployment in the North be part of the same syndrome?)

However, settlement day soon arrives and you pay your money - real money at last. This brings home that, since the day you said "Buy", you have been part owner of a real company made up of real, striving people and buildings and machines. It is only too easy to forget this reality in the "game" of finance. But we must return to this game, which is our subject.

"My Stockbroker". Somehow this magic expression seems to shift one into a new plane. The Walter Mitty in most of us springs to life and we dream: 'Rochefeller Smith says "BUY" and twenty bankers hit the dust'. But stockbrokers are really quite ordinary people - and, it seems, remarkably trusting. The first time my stockbroker became aware of my existence was when first I rang him. I said I wanted to invest a little money - what would he recommend. He said "Distillers and Foreign and Colonial." I gulped a bit, silently I hope, thinking they both sounded very dubious and either immoral or obsolescent. However, I was now in the big sophisticated outside world so I said "Yes" to a small number of each. I then said "What about references," and started to tell him the name of my bank - "No, no", he interrupted, "Never mind, we shall take care of everything." So I put down the phone, back in my world, somewhat shaken. I had taken the bait and things were never quite the same again.

Soon I was subscribing regularly to the Financial Times. The sober organ of Capitalism is, curiously enough, actually printed on pink paper. A copy under one's arm is therefore recognisable ever at great distances. This fact must be constantly remembered: though it may make one feel at home in the City, the paper must be carefully concealed when asking for a rise or walking through a strikers' picket, though I suppose than even shop stewards own shares (in the rival company?) these days.

The world that the F.T. describes seems somewhat unreal, as if itself viewed, so to speak, through rose-tinted glasses. It is flattering

THE STOCKMARKET GAME - (cont'd)

even to read the advertisements: "Ask your secretary to enquire about this camera - it costs only £250, much less than the annual depreciation on your car"; or "When you next renew your fleet of cars, consider the Triumph Herald" or "Your salesmen create a better impression in a Vanguard." Actually, however, the body of the paper is surprisingly readable, and even has very good reviews of books, theatre and cinema.

All the vital information is there too: "Woolworth pays a penny more"; "Little Spring in the Mattress Market"; "Vacuum Cleaners: Home Market Cleaned Out". Comments are also made on progress in science and technology. Often other important advances are also recorded - the issue of 9. 1. 63 contained this paragraph:

> "An interesting development in graffitology comes from a pub in Marylebone High Street. A blackboard and chalk have been installed in the gentlemen's rest room."

But I have digressed. Let us return to the subject of buying shares. This can also be done through your bank, although you then must forego the glamour of direct contact with the other world. Your bank manager has an only too familiar, earthly face. He also knows about your earthly balance. But in any case he usually cannot give the urbane and specialized advice which the stockbroker provides. The bank manager has to be more careful; he knows that you will be seeing him, face to face, many times in the years to come.

The stockbroker gives his advice free, but when you buy (or sell) he charges a commission of about 1½% (¼% on government stock) which is added to your bill together with 2% stamp duty. The bank charges you the same commission if you deal through them - they split it with their broker who actually does the buying. On the Stock Exchange, shares can only be bought or sold through a broker who is a member of the Exchange.

You cannot by-pass the broker. But, you need not worry if he absconds with your money: a sort of insurance scheme is operated by all the brokers and you will get your money back. The offending broker will then be "hammered" on the floor of the Exchange. This most savage penalty is, however, seldom necessary.

Having received your instructions, the broker tries to buy the required shares at the right price. We now come to a link in the chain between buyer and seller which is probably unique to England - the jobber. The jobber is a sort of wholesaler of shares. He has a stand on the floor of the Exchange and can only deal with brokers, not directly with the public. Your broker walks up to a jobber whom he knows specializes in the type of shares you want and asks him for a quote for, say 100 Daintifyt 'A', without saying whether he wishes to buy or sell. The broker may reply 17/-, 18/- meaning he will buy at 17/- and sell at 18/-. The difference in the price, 1/-, is the jobbers "turn", which is roughly his profit. Daintifyt Bros. is a relatively small firm, (750,000 shares of 4/- each) and may be considered as somewhat speculative, so the jobber sets a wide margin, 1/- or nearly 6% to safeguard himself against fluctuation due to the small numbers of transactions in this share. Incidently, each transaction is called a "bargain", even if it is not. In the case of a very large company, e.g. BMC, he might quote 14/3, 14/6, a turn of only three pence or 2%, because he knows the market is more steady. It is the jobber who must ensure that $\oint$ I.da, where I is the flux density of shares and the integral is taken over walls, floor and ceiling of the Stock Exchange, is equal to zero. He must set his prices so that enough buyers come forward even when most people would like to sell; and especially he must not get caught with too many shares on a falling market. You might think the jobber will make his fortune on a rising market, but, we are told, "competition between jobbers prevents their profits from becoming excessive".

We can now give a rough estimate of the profit made by the middlemen in a single transaction: the buyer's and seller's broker each get about 1½% commission, the jobber say 3% and the Government 2%, (stamp duty is paid only by the buyer). This adds up to a good slice of the cake - 7½%. Putting it another way, if you switch your money from one company to another (other things being equal) you automatically lose about 7½%, which is equivalent to rather more than the income you would expect your capital to earn in one year. Hence, you don't sell and buy without good reason.

Costs can be reduced by 1½%. if you sell and buy within a single account period of two or three weeks. Also, if you buy and sell the same stock within the account, no stamp duty is payable, and only one commission - to make a profit in this case you don't have to do much more than beat the jobbers ... and the experts. You may also find it useful to know that in dealing in over £50,000 of gilt-edged, reduced rates of commission apply!

In this article I have dealt mostly with some of the mechanics of the buying and selling. In a future issue (unless I am in South America by then) I shall describe, inter alia, some of the pyscological types which inhabit this other world - the bulls, bears, and stags, and kindred beasts.

Extract from the current issue of 'Bulletin of the Institute of Physics and Physical Society' - University of Oxford: Imperial Chemical Industries Research Fellowships.

'The fellowships (which are open equally to men and women) are for research in physics or chemistry, these subjects being doomed to include physical chemistry, biochemistry, colloid science, chemotherapy, pharmacology, engineering, metallurgy, or any other subject of study which is in the opinion of the committee related to the study of chemistry or physics'.

Nimrod

A Sculpture by Jim Dixon

Harry Norton

Nimrod, 'the mighty one in the earth', has captured the imagination of most of us at one time or another and perhaps each one of us has his own mental picture of 'the mighty hunter before the Lord'. Early Biblical writings present him as the first of the great kings, surpassing all those who came before, marking a new era of leaders.

Around Christmas time, we in Power Supplies became aware that the imagination of one of our number was remarkably vivid. Indeed, not only had Jim Dixon researched the scant information available but he had created an impressive sculpture model of Nimrod embodying the concept and mechanism of our Proton Synchrotron with the history and mystery of Nimrod the great leader.

The model, about eighteen inches high, first appeared standing centrally above the clock over the switching panels in the control room, lending an aura of dignity to the general aspect and blending perfectly with the strength and stability of its surroundings.

It was inevitable that such a striking figure should provoke a good deal of discussion and an impressive number of attempts were made to interpret the artistic symbolism so manifestly present in this striking work. The power and strength in the flowing lines were immediately apparent but the realisation that the human form is merely suggested rather than accomplished comes only after a more detailed examination of the model. Interest grew and spread and Nimrod became 'Our Nimrod'. With the growing interest, grew the popular demand for an authentic interpretation of this fascinating study and Jim Dixon did not disappoint us.

His basic aim was to depict Nimrod the mighty hunter, rising from the earth and to express the act of rising by allowing the extremity of the right limb to remain in the earth forming the base of the upward sweeping curve which constitutes the main movement line of the figure. Notice, there is here no reference to arm, leg or foot since it is intended to symbolise mankind as a collective power by the use of a generalised human shape rather than a more precise reproduction of the human form. Again, the figure is faceless representing the composite faces and skills of all men.

So Nimrod is seen rising and reaching, to grasp from the ancient elements the power, which the execution of his task demands. The power is symbolised as electrical power which flows with wavelike motion in the flowing lines of the limbs, converging with directness and strength to the straight line of the spine. From there the rest follows. The concentration of power at the loins with the magnet of eight octants clamped and constrained by the left limb.

What the admirers of the miniature Nimrod did not appreciate at that time was that the artist conceives his work not only as a shape, an art form, to be worked into something or other, but as a complete work, complete in all details of shape and size and materials and technique of which this minature Nimrod is a model. If we were impressed with what we had seen, the idea of the ultimate creation was indeed to anticipate.

Jim Dixon outlined his ideas on the completed Nimrod as being twelve to sixteen feet high, made from concrete on a carcass of steel reinforcement and clad overall in polished aluminium. He considers that this size would be necessary to give stature and grace to a larger than life creation. At one extreme, the curving limbs do not lend themselves to reproduction as a colossus while a man sized figure would certainly lack grace and would, in all probability look puny. The choice of materials was the result of a search to find a medium which would blend with the modern buildings and building techniques used at the Rutherford Laboratory. Clearly, traditional materials like granite or sandstone would be incongruous in such a setting. The use of polished aluminium is at once intriguing and novel. This would use the infinite variety of lighting conditions which our climate and seasons provide, to give us a new Nimrod every time we looked and from every position we happen to be in, emphasising the enigma of the mysterious Nimrod.

The position where such a sculpture might stand has been a subject of lively discussion among those who have seen the model. Perhaps among small shrubbery, set apart from the main buildings. Possibly positioned adjacent to a main approcah to Building R.1 on open ground.

We do not doubt for a moment that Jim Dixon has the necessary creative skill and ability to accomplish this exciting work, any man who takes the creation of an eight foot angel in sardstone in his stride as he has done, is worthy of our complete confidence, particularly since his preliminary work has evoked such a tide of interest and enthusiasm. Can we look forward to seeing our own Nimrod in the not too distant future?

The sculpture model of Nimrod will be on display in the Main Entrance Hall of R1 from Wednesday afternoon, 30th January. All comment, formal or informal, is encouraged and we hope that Jim Dixon's sculpture will gain the enthusiasm of the whole Laboratory.

Electron Laboratory

Information extracted from the Minutes of the Fourth Meeting of the Whitley Council on 23rd November.

Staffing:

The parameters of the machine have been fixed; the machine will be 4 GeV with an output current of 4 microamps. An effort equivalent to about 15 to 20 full time staff has been working on the design of the machine for about 18 months. These are staff of the Rutherford Laboratory and the Universities of Liverpool and Glasgow.

The total staff is expected to be about 250; about 40 by March, 1963, and 140 by March, 1964. Vacancies for the Electron Laboratory and arrangements have been made to circulate them also in the Atomic Energy Authority.

Housing:

The housing situation in the area is generally better than in the Rutherford Laboratory area; some speculative building is going on at Runcorn, Frodsham and in surrounding villages. The Official Side undertook to provide copies of housing advertisements in local papers to give the Staff Side an idea of typical housing costs.

A definite decision has not been taken regarding the provision of Institute houses; neither has any approach been made to local authorities to build on the Institute's behalf. A decision in this matter must await circumstances - the ease or difficulty with which staff could themselves obtain accommodation being the main consideration.

Machine Experiments:

The Staff Side asked what experiments can be performed on the machine which could not be done on the American and German electron synchrotrons. In reply, Professor Merrison said that the character of experiments 'around the machine' had changed and the Daresbury accelerator would enable experiments to be done in the machine itself: the long straight sections (3.5 metres) were designed to this end. He added that there is plenty of work on the structure of the nucleon for the three machines to do: perhaps for even twice that number.

It was stated that the site is being so laid out that other developments or projects can be added if required although none was planned.

News from CERN

CERN to expand into France

CERN could be the first international organisation with a site extending on either side of an international frontier. The French Government is willing to put at CERN's disposal an area of land, about the same as that already occupied by CERN, immediately adjoining the present site. It is estimated that about a year will pass before CERN takes possession of the new ground.

The Budget for Nuclear Physics Research in 1963

The 23rd Session of the CERN council voted a budget of 94.2 million Swiss francs (1 Sf is equivalent to about 1/8d.) to pursue its basic research in nuclear physics in 1963. Of this amount the United Kingdom pays 24.17%. The new budget represents an increase of 13% over that voted for 1962 together with an allowance of 3.6% for price increases.

The Success of 1962

Prof. Weisskopf, the Director of CERN, said in addressing the Council, "1962 was a decisive year for CERN which has now a healthy scientific programme exploiting reasonably well the opportunities of the two accelerators, within the limits of our present state of development.

"CERN, in collaboration with other researchers in Europe, has contributed important results in the lines of research which seem to be the centre of interest today in the world-wide quest for knowledge of the constitution of matter. CERN has established important facts which have enabled it to emerge for the first time as one of the leading institutions in this field of research. The achievements of CERN are those of scientists all over Europe, since a large part of its experiments are studied and evaluated elsewhere."

About 300 physicists from other Laboratories including some from the Rutherford Laboratory now work on material available from CERN, such as nuclear emulsions and bubble chamber films, or take part in experiments as visitors.

"The success of the Laboratory does not mean however that CERN facilities are fully exploited. The member States who brought CERN into being should support the exploitation of CERN in the same spirit as they fully supported its construction. A full exploitation of CERN will require 2200 or more personnel compared with the 1450 it has now."

ALICE

In our last issue we asked for any thoughts on the name of the Electron Synchrotron. Harry Atkinson had suggested 'ALICE', as the machine is to be built in Lewis Carrol's home town. Bill Galbraith, the inveterate namemaker who already has 'NIMROD' and 'ORBIT' to his credit, filled in the letters as 'Accelerator Laboratory in Cheshire for Electrons'.

Personnel News

Suggestion Awards

The fourth meeting of the Rutherford Laboratory Suggestions Award Committee was held on Monday, 21st January, 196' and congratulations are extended to the following personnel:-

C. Wallis - Encouragement Award £1.
P. Seagar - Final Award £1 (in addition to previous interim award of £1).
J. P. Wiggins - Award of £2.
T. Morgan - Encouragement Award £1.
P. R. Mace - Award of £2.
P. G. Whelan - Encouragement Award £1.
P. J. Champ - Award of £10.

The Committee expressed disappointment at the poor response to the "Safety Poster" competition, to date only one entry has been received, and expressed the hope that more entries would be submitted for consideration at the next meeting. It is also hoped that more members of the Laboratory staff will take an active interest in the Suggestions Scheme.

The Suggestion Awards Committee will be meeting again on 11th February 1963 and suggestions for consideration should be placed in one of the Suggestion Boxes or forwarded to the Secretary, Suggestions Awards Committee, Building R.20.

D. Rose

Comings and Goings

A. G. Bell and J. B. O. Howell join the Atlas Laboratory.

Miss N. K. Davies joins Administration;
Mrs. P. D. Bennet joins Personnel.

W. R. Evans and C. L. Wray join Nimrod Engineering;
S. R. Nash, W. F. Golding and W. T. Smith join Central Engineering.

Miss B. J. Compton and D. J. Smith join Theoretical Physics.

J. F. E. Bradley joins Nuclear and Radiochemistry;
M. N. Wilson joins Nimrod Beams.

H. J. Down and C. J. Moody join Bubble Chamber;
R. A. Hunt joins Electronics.

J. F. Crawford joins High Energy Physics;
D. A. H. Longstaffe joins PLA Accelerator Physics.

Janet Morgan (Partington) has left us

R. Kur has been granted two years unpaid leave to attend a course at Colchester Technical College from 1st January.

Congratulations to -

Neville Haycox, one of the inspectors at Marston Excelsior soon to take up an appointment at the Rutherford Laboratory, and Miss Judy Lythe of Leeds who announced their engagement on Christmas Day.

Malcolm Mitchell, of Theoretical Group, and his wife Jean on the birth of a daughter, Patricia Mary, on 10th December.

Housing News :

Pecple on the housing list will be pleased to hear that a contract has been placed with F. Minns and Co. Ltd., Oxford for thirty more houses on the Rush Common estate in Abingdon. The first of these should be available in July of this year.

For 'Harwell' read 'Chilton'

As from 14th January the correct postal address of the Rutherford Laboratory became:

National Institute for Research in Nuclear Science,
Rutherford High Energy Laboratory,
Chilton,
Didcot,
Berks.

A Comparison of the Qualities of PLA Scientists and Engineers .

by A Carne

Introduction

Since the P.L.A. Scientists and Engineers are such a happy, brotherly, "all-pull-together-chaps" lot, comparison between them is difficult and odious. Resolution can be achieved by the Ten Pin Bowling Test (Rank, 1951). As in all psycho-physical tests a reward was to be made to winning team, in the form of a genuine brass accelerator imported from the Chinese Government.

The Experiment

The experiment was performed on the evening of January 18th, 1963 at Swindon. Samples of Scientists and Engineers were grouped into four teams of three, and four runs were made simultaneously. Proton models (bowls) were hurled at four identical targets in the form of ten pins arranged in a triangular lattice. The comparison was made by counting the total number of pins knocked down, which in turn depended on several factors:

(a) Injector condition (at this part of the test, sober).

(b) Alignment (it was found that large radial displacements caused the bowls to fall into deep potential wells, which steered them clear of the target).

(c) Polarization (this in general was random, though the bowls had finger holes to assist polarization. Many engineers had difficulty getting their fingers out).

(d) Style (this may well have helped, but it didn't).

Despite the fact that the targets had a surprisingly small cross section, a total number of 1850 $\pm$ 42 counts was recorded, of which the Scientists claimed 984 and the Engineers 866.

Conclusion and Discussion

At the discussion, held later at "The Steam Train", it was declared that 984 being greater than 866, the scientists were the winners. The captain of the Scientists' team duly presented himself with the reward, which was called the P.L.A. Bowling Trophy, 1963. There was indeed much discussion, during which the teams said healthy, but rude, things about each other. And drink, and fish and chips, and songs.

Acknowledgement

Thanks are due to Mr. R. Wilson whose meticulous planning, and knowledge of where a Bowling Alley was, helped to make the experiment a success.

A news release from Berkeley -

UC Scientific Team Finds New Particle

A University of California Lawrence Radiation Laboratory research team has discovered a new human particle. John Olmsted, spokesman for the group, announced today that the particle's existence was established in final experiments as Kaiser Hospital in Oakland at 3.15 a.m., October 14, 1962.

The particle has been named Jennifer Claire at the suggestion of Group Leader Eileen Olmsted who guided the nine month program to its completion. At this time little is known of the Jennifer Claire's properties other than its rest mass, 8 lbs. 6½ oz.; charge, f and principal dimension, 20½ inches, but the Olmsteds will research the particle more fully to determine its place among the building blocks of nature.

Today Olmsted stated that he feels that the Jenrifer Claire is the first of an entirely new line of particles and that future experiments will probably uncover other members of this family. His group leader was not available for comment concerning this opinion.