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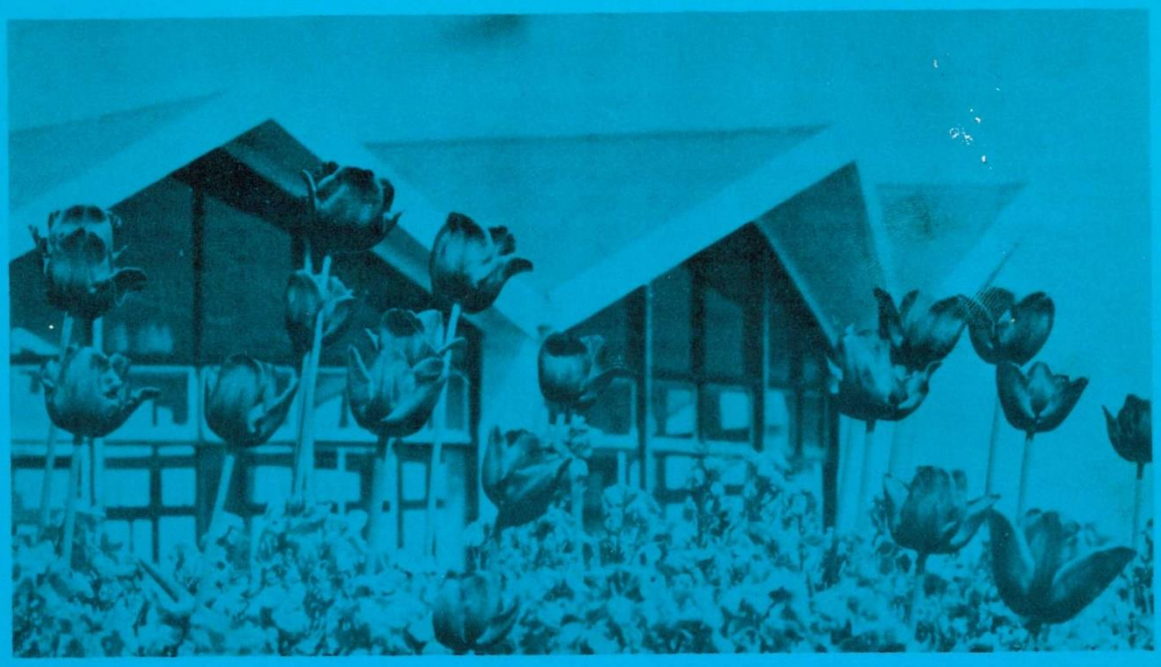

Cover photograph:

Spring comes to the Rutherford Laboratory. A view through the tulips outside the Restaurant.

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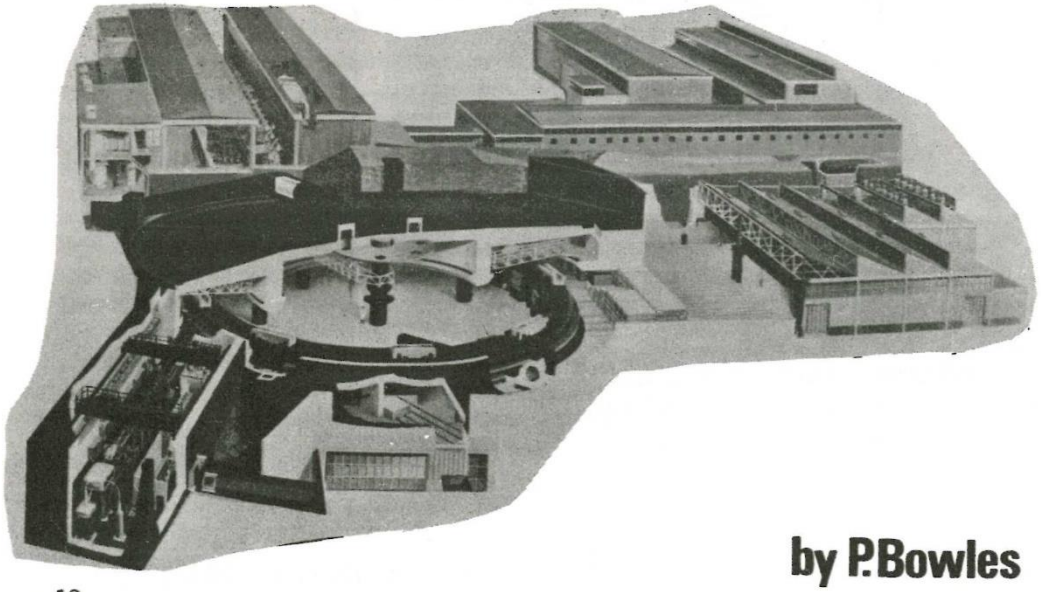
On 7 January, 1965, Mr. Bowles, Chief Engineer, gave the 7th Hunter Memorial Lecture to the Institution of Electrical Engineers at Savoy Place, London. We are reproducing here, part of the condensed version of the Lecture which can be read in the May issue of "Electronics and Power". (Incidentally, the issue also contains articles by O.R. Frisch "The particles of modern physics" and N.J. Felici "Electrostatic generators"). One of the three problems selected by Mr. Bowles for his lecture is detailed in this article. The engineering aspects of our Laboratory projects are not often highlighted in ORBIT and this is a suitable opportunity to illustrate the significance of the engineering contribution.

The art of the engineer is a personal expression in the development of ideas, the application of laws, the selection of materials and the direction of effort to make a purposeful product. This product is often recognised entirely as an engineering enterprise, but, in this most exciting and technically progressive age, the engineer also finds himself working in co-partnership with many other disciplines in building scientific apparatus for the research worker who, though pre-eminent in his own field, may not be equipped to design and make his own apparatus - as was the practice a few decades ago. In these circumstances the engineer has a great responsibility, since the limits of the research are often dependent upon what engineering can achieve. This is particularly so in the field of high-energy physics.

In this field the research objectives have sometimes determined the energy of the machine to be constructed; often the pacemaker has been the accelerator designer, who has provided the physicist with an improved device for exploring what lies behind the threshold of knowledge at that time. In launching a project, however, the following factors determine the choice: research objectives; availability of other accelerators; the knowledge available; the extrapolation risk; capital likely to be available.

In 1956 consideration of these points led to the proposal to build a synchrotron to accelerate protons to an energy of 7 GeV, with a particle

Some Engineering Problems of the Proton Synchrotron NIMROD



by P.Bowles

yield of 10^{12} protons per pulse, and to have a variable repetition rate.

Design considerations

Following the basic specification, the machine designer has to consider machine stability, materials, accessibility to the machine parts, and environmental conditions. Maximum flux density in the magnet gap and energy determine the physical size of the machine, the beam-focusing system and particle yield; the aperture of the magnet, the magnetic field at injection and injection energy are interrelated. Both radiation damage and dimensional stability effect the design of specific components of the plant, such as injector, magnet, vacuum system and r.f. accelerating system. The magnet power supply must have regard to other users on the network, and the control system must ensure not only the correct time relationship of the variables but correct amplitude relationship throughout each pulse.

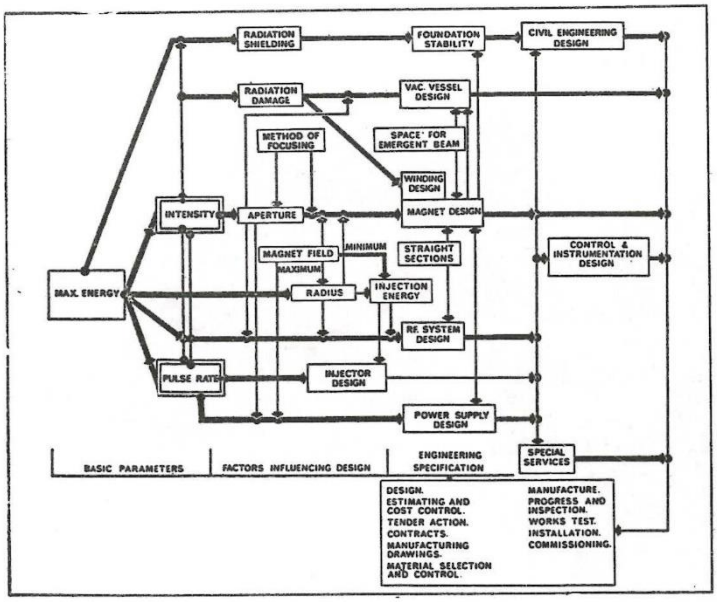
Exceptional care is required of detail; the instrument is large, takes a long time to construct and requires the on-site assembly, with tool-room precision, of thousands of parts coming together for the first time. This theme is illustrated by the following example: The accurate placing of the magnet sectors, and foundation stability.

The example is a mechanical one, but as every electrical engineer knows, the basis of most manufacturing processes involves mechanical engineering principles. It was a long time before much of the electrical engineering industry appreciated this, and care must be excercised to ensure that, in this age of specialisation (particularly in the light-engineering field) this deficiency is not repeated.

Structural Stability

Great care was taken in the manufacture of the magnets, optimising the quality and selectively positioning the sectors. This had to be matched with similar care in ensuring foundation stability and correct alignment. The magnet must remain planar throughout the life of the machine, radial symmetry must be preserved and each block must remain perpendicular to the orbital plane.

Given that the foundation should not hog or sag more than 0.040 inch, nor tilt more than 1/4 inch across its diameter, and that relative settlement should be minimised, the site at Chilton, was approved by trial pits, load tests and boreholes to confirm the absence of voids and the Geological Survey's prediction that the lower chalk was about 230 foot deep. The combined loads of the building, shielding and machine were large and entailed the stressing of the whole foundation area to about $2\frac{1}{2}$ tons per square foot. To avoid expansion problems, the magnet room



The inter-relation of the aspects of synchrotron design

is kept at a constant temperature, irrespective of whether the machine is operating or not, by passing cold or warm air through the duct in the monolith and using simulated heat loads. Lack of symmetrical conditions gives a saucer effect to the upper flange, and loads down the pillars from the roof which carries the radiation earth shielding (10-20 foot thick) also cause distortion of the monolith.

These variations, although small in a normal structure, had to be considered in regard to the specification for final accuracy. The photograph shows a cross-section of the machine foundation and the positioning of the sectors.

A fundamental point in the survey was the determination of a strong geometrical pattern to match the machine geometry, and to orient it in the correct position relative to the building. Under difficult site conditions, settings of the floor marks were in error by less than 3/8 inch in plan, and the magnet bedplate was level to within $\pm$ 1/8 inch. Special equipment was designed to measure length to limits usually associated with precision-workshop metrology. Information from eight surveys over three years enabled computed co-ordinates to show the error of each datum. Data relative to the absolute were finally known to within 0.008 inch in plan and 0.002 inch in height at a confidence level of 95%.

Measuring height and tilt

Sectors were aligned by first positioning six principal sectors and using the special survey equipment. Heights and tilts were measured using a surveyor's precise level and a gap-face levelling fixture. All the remaining sectors were positioned for height and tilt by the same method, but their radical position was adjusted by metrology. The complete operation took four months, but every sector lay between the limiting planes 0.020 inch apart.

All the foregoing was the foundation work for the polepiece installation. Polepieces, besides their main function, support the vacuum vessel against collapse. Their position is therefore affected by the thickness of the vessel skin, which varied from the mean by 0.02 inch. This variation was overcome by fitting non-metallic shims.

Polepieces were first installed on the principal sectors, height and tilt being measured directly, as for the sectors, and the intermediate pole-pieces faired in using metrological techniques. Clean conditions were essential, and the operation went on 12 hours a day, seven days a week, for ten months.

The overall survey showed that all sectors were set within $\pm$ 0.005 inch of the mean orbit path of 63 foot 6 inch radius, and pole-pieces were correct to sectors within $\pm$ 0.003 inch. Heights of

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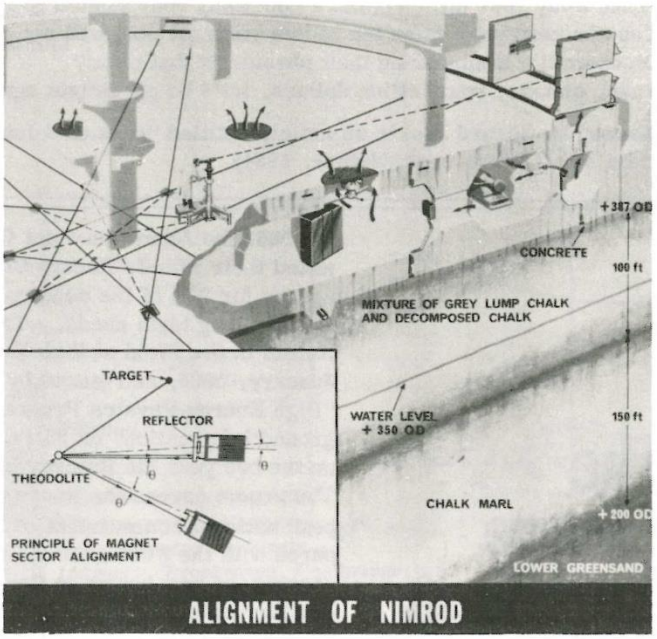
In his vote of thanks at the end of this lecture, Mr. L. Drucquer compared Mr. Bowles with Frankenstein - a man who had to live with the monster he had created.

The Alignment of the Nimrod Sectors



polepieces were set to 0.010 inch when first installed but drifted to ± 0.020 inch under the influence of roof loading. 95% of the polepieces had a tilt less that ± 0.003 inch when measured across the width and depth of the pole faces; 50% had a tilt less that ± 0.001 inch.

In the construction of a large project, many things happen simultaneously and often conflict with one another, affecting the ordered way of how and when operations should be carried out. In this case it was impossible, without catastrophic effects on programme and cost, to delay survey work until the roof mounding was complete, and the price paid was the minor deviations from the specification at two points.

Summary

This example is illustrative of the care required to engineer a basic idea. Many of the major problems are difficult to foresee at the outset. It is an exercise where principal objectives are well and easily definable, but where obstacles have to be surmounted by a combination of ingenuity and hard work. Many disciplines of science and engineering have to join hands in a co-partnership requiring judgment of which available ideas should be pursued with the available resources. With enthusiasm and talent it is rarely the case that one has to turn back because solutions are not available. More often there are competitive solutions and one has to avoid the pitfall of spending too much time in evaluating the best; for it is axiomatic that the nearer equal two solutions are, the more time can be lost in evaluating the better.

One message I wish to convey is that the success or failure of a project, once launched, depends more on attention to detail than on principles. Engineering specialists may need to create new ideas, but experienced engineers must equally well execute them. It is a complementary partnership, which can best be expressed in the words of Samuel Johnson:

"The philosopher may be delighted with the extent of his views, the artificer with the readiness of his hands, but let the one remember that without mechanical performance profound speculation is but an idle dream, and the other that without theoretical prediction dexterity is little more than a brute instinct".

Engineering is proud to embrace Dr. Johnson's "complementary talents", since this spectrum offers youth a challenge, providing exceptional opportunity to develop interest and ability with individual expression. Throughout the engineer's career, scholarship will become tempered with experience for the advancement of the art, the satisfaction of his person and the benefit of others.

" I would like to suggest that the criteria for all forms of civil technology should be human effectiveness. Every bit of research, every engineering development, every industrial enterprise must be for the ultimate benefit of people."

Duke of Edinburgh, "The Challenge of Modern Engineering". Conference at Cambridge.

'Take away your billion dollars take away your tainted gold,
You can keep your damn ten billion volts my soul will not be sold.
Oh dammit! Engineering isn't physics is that plain?
Take, oh take, your billion dollars, let's be physicists again.'

(Quoted by Gerard Piel in an article entitled "Role of Science in India's Self Discovery" Nature, 1964).

The Future American Programme

In 1964, the American Joint Committee on Atomic Energy (JCAE) asked their Atomic Energy Commission (AEC), which is the executive agency for 90% of the country's high energy physics research, to outline the long term needs. The AEC report, "Policy for National Action in the Field of High Energy Physics" was presented on 24 January, 1965, and issued by the U.S. Government Printing Office as "High Energy Physics Program: Report on National Policy and Background Information" on 25 February. This is the first official action on the two year old Ramsey Report (see ORBIT June, July 1963). The report covers the future programme up to 1981 and anticipates a peak national commitment of $500 million in the 1970's. This is compared with the $600 million of the Ramsey Report. President Johnson, passing the new report to Congress, endorsed it "as a useful guideline for decision making in the development of high energy physics". (It should be emphasised that the report is not through Congress as was implied in the last issue of ORBIT).

The specific proposals made in the report are as follows:

1. Construction of a high energy proton accelerator of approximately 200 GeV, in accordance with technical specifications developed by LRL, (Lawrence Radiation Laboratory, Berkeley) to be operated as a national facility. This machine should be authorized for design in fiscal year 1967, and for construction in fiscal year 1968.

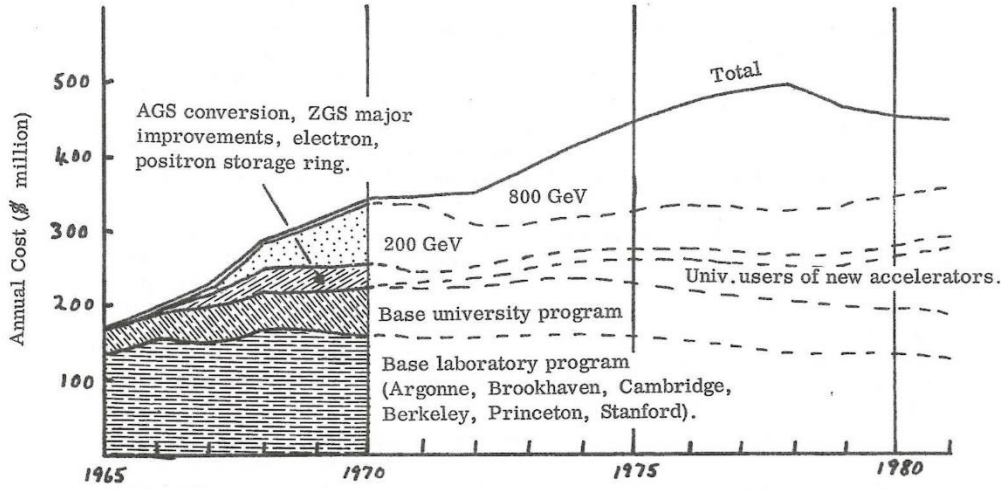
2. Conversion of the Brookhaven AGS (33 GeV Alternating Gradient Synchrotron) to a high intensity facility. Phase 1 of this conversion should be authorised for design in fiscal year 1966; and for construction in fiscal year 1967.

3. Upgrading of the Argonne ZGS (12.5 GeV Zero Gradient Synchrotron) by an improvements program which will include a new experimental area, a large bubble chamber, and a higher energy injector. The large bubble chamber and experimental area should be authorised in fiscal year 1966. The higher energy injector should be authorized in fiscal year 1967.

4. Construction of a high energy electron-positron storage ring facility as an adjunct to the SLAC accelerator (Stanford Linear Accelerator Centre, 20 GeV electron linear accelerator). This should be authorized in fiscal year 1967.

5. Support of the study of new accelerator principles and techniques. In particular, support should be provided for intensive design studies aimed primarily toward a future national accelerator in the range of 600 to 1,000 GeV. Support and encouragement should be given to these studies for the pursuit of new ideas which could lead to a more capable and efficient machine at lower cost. It is anticipated that these studies would lead to a request for authorization of construction in fiscal year 1971 of a 600-1000 GeV-class proton accelerator which would be available for experimentation in fiscal year 1980. Consideration of high energy storage rings for possible future addition should be included in these design studies.

The Annual Cost of the American Programme



6. Support for the development and utilization of new and improved techniques and methods of particle detection and data reduction and analysis, including the strong need for advanced computational facilities.

7. Continued and increased support of the productive accelerators presently in operation or under construction and their associated research programs, without neglecting the need for new facilities. This includes taking steps to increase their scientific value and productivity where needed to maintain a sound scientific program. It also includes recognition of the special need for substantial operating and research budgets for the newest accelerator laboratories before they come into full operation.

8. Construction of large bubble chambers and other accelerator-associated facilities when justifiable needs arise. It is anticipated that two or three large hydrogen bubble chambers should be started within the next 1 to 3 years.

9. Increased support of university high energy user groups including buildings, major equipment, and particularly data handling and analysis facilities. The user group concept has proven to be both feasible and highly productive and is essential to the future of the national program.

10. Close down or reduce the level of operation of those accelerators which become relatively unproductive. The prime considerations involved in continuing an accelerator program are its scientific significance, and the capacity of the associated research group to carry out a worthwhile and significant program. Additional factors, such as the educational function served by the accelerator and its use in preparing experiments for more costly facilities, are also important considerations in assessing the value of a machine.

11. Provide for an overall review and reassessment of the high energy physics programs at suitable intervals.

The following additional information about these proposals may be interesting:

1. The LRL will issue the detailed design study of the 200 GeV machine in the next few months. The main features are a 200 MeV injector, an 8 GeV booster synchrotron and the main ring almost a mile in diameter of 500 magnets with three accelerating cavities; pulse repetition rate 1 per 2 seconds; design intensity 3×10^{13} particles per pulse; power demand rising to 180 MW in operation; cost estimate $280 million; annual operating expenditure about $60 million. If construction starts in 1968 the machine could be completed by 1973. Although the Ramsey Report specifically recommend the building of this machine at Berkeley the new report does not mention any possible site. It is observed that selected sites should provide "the greatest overall advantage to the government and high energy physics program. The location of a design study group should not determine the site for an accelerator laboratory".

2. The Brookhaven AGS conversion to higher intensity is considered in two stages. Phase I would see an increase from 10^{12} to 8×10^{12} protons/second by installing a 200 MeV injector to replace the 50 MeV injector and by doubling the machine repetition rate, which would involve increasing the size of the magnet power supply. The cost of this stage, which would be complete by 1970, if construction begins in 1967, is given as $47 million. Phase 2 would give an additional factor of 2 or 3 by taking the injector energy to 500 MeV. It is pointed out that this would be the only major advance in U.S. accelerator capability before the 200 GeV machine came into action.

3. The Argonne ZGS would be converted to intensities greater than 10^{13} protons/second which would be achieved by installing a 200 MeV injector. The bubble chamber referred to is a 12 foot long Heavy Liquid Chamber (2,000 gallon capacity, eight times larger than any in operation).

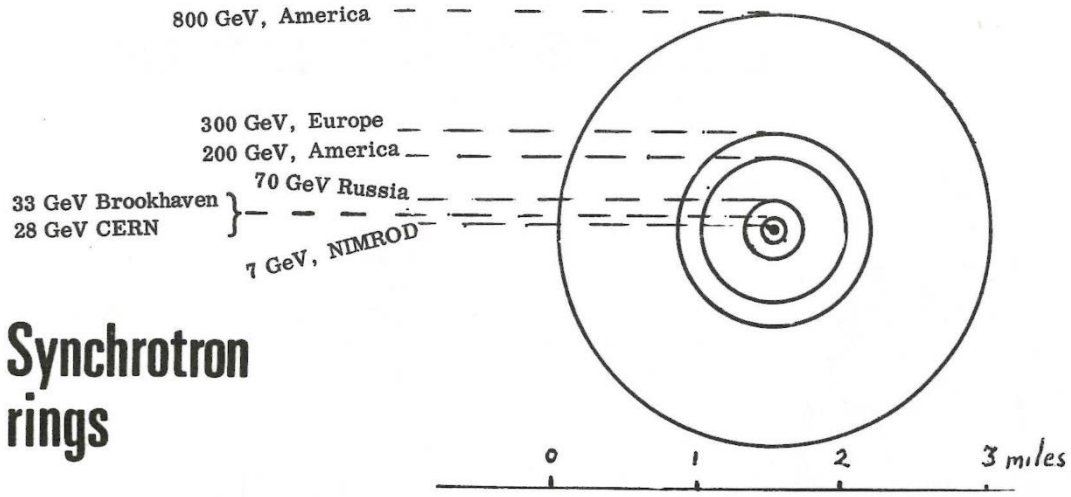
4. Electron-positron storage rings at a cost of 15 million (at the Stanford Linear Accelerator Centre) of energy 3-4 GeV is the only specific storage ring proposal in the report. This would yield interactions equivalent to a 60,000 GeV electron striking a stationary positron. Electromagnetic studies of strongly interacting particles, possible production of the "intermediate boson" and more refined checking of quantum electro-dynamic theory (down to distances of 10^{-15} cm) would be experiments for this facility. The Ramsey Report recommendation for storage rings at the Brookhaven AGS has been dropped. It is considered that the increase in intensity of the AGS will be more fruitful, yielding greater diversity of experiments. The strong intention to build storage rings at the CERN 28 GeV machine seems to have influenced this decision and the report suggests that the US might finance an experimental area on the CERN facility. If CERN do not go ahead with their project it is recommended that the decision on Brookhaven be reconsidered. The report also suggests that storage rings might be added to the Cambridge 6 GeV electron synchrotron and the 10 GeV Cornell electron synchrotron. The Cornell machine and the SLAC are the only major accelerator projects currently underway in the U.S. (The first ever particle collisions in storage rings was reported from Stanford in March of this year. Two 300 MeV electron beams, travelling in opposite directions were made to collide. The collision is equivalent to a 360 GeV electron striking a stationary electron in a target. The rings were fed by the Mark III linear accelerator and electrons have been stored for periods up to 35 hours. The beam current in each ring is about 30 milliamps)

5. Brookhaven expects to produce a detailed study on the 600-1000 GeV Machine in about a year's time. Argonne are also now engaged on this work. Whereas the 200 GeV machine has been pursued as a direct extension of known techniques, new accelerator principles are being considered for the higher energy machine. Based on meetings with Russia and Europe, international collaboration on the 200 GeV machine is thought very unlikely but the magnitude of a 1000 GeV project, it is considered, might induce worldwide collaboration. The report also proposed the setting up of a National Corporation to manage the new facilities extending the principle operating at Brookhaven where management is a nine-University collaboration (Associated Universities Incorporated).

6. Superconducting magnets and superconducting linear accelerator cavities are included in the new techniques to be pursued.

8. In addition to the huge Argonne chamber, a 7,000 gallon, 14 foot chamber costing $16 million, exclusive of experimental area additions, is recommended for Brookhaven. Brookhaven have already, unsuccesfully submitted this for inclusion in the 1966 budget.

10. Possible dates for the shutdown of some of the existing accelerators, subject to the recommendation of the Review Committee are, 3 GeV Cosmotron (Brookhaven) - 1968; 6 GeV Bevatron (Berkeley) - 1974; 6 GeV Cambridge electron synchrotron - 1978; 3 GeV Princeton proton synchrotron - 1978.



A Colloquy was held to place the report in perspective and to communicate the needs of the high energy physicists to the JCAE panel and to the public. This colloquy is reported in considerable detail in the April issue of "Nucleonics". Most of America's top HEP scientists attended the colloquy. Some quotes from the proceedings follow:

"We are more or less obliged at this point to examine whether the historical experience should hold in connection with what goes ahead.. Congress should not abandon its responsibility to oversee the spending of people's money or turn it over to some non-government group of university presidents or physicists...The whole management concept should be evaluated by somebody, some group of people knowledgeable in ways of management, from the outside, so that we have some new input". Representative Craig Hosmer.

Representative Chet Holifield quoted a forthcoming National Science Foundation Report to the effect that in terms of total national investment in research and development (government plus industrial), high energy physics ranks ninth.

High energy physics..."has contributed comparatively little toward meeting the needs of society...For reasons of its importance to science and because of philosophical values, high energy physics should be supported, but the highest values should be assigned elsewhere". Philip Abelson, Carnegie Institution.

High energy physics is "at the top in the cultural sense"
George Kistiakowsky, Harvard.

We will have a "monolith structure of science if we pin all our hopes for an order of things on high energy physics"
Eugene Wigner, Princeton.

"To degrade high energy physics because it has no practical application is foolish"
Emanuel Piore, IBM

"Every increase in energy makes possible new and revolutionary discoveries. In no case in the past have scientists been disappointed in the results following an increase in available energy".
Edwin McMillan, LRL

"There is an essential lesson here in that progress does stop when experimentation - testing of ideas - stops. In physics an idea is good only if it can be tested. Most frequently it is good only until it is tested"
Val Fitch, Princeton.

Senator Clinton Anderson asked Professor Weisskopf (Director General of CERN) if he was trying to set up three bases for research (U.S., Russia and CERN). Weisskopf replied "I prefer to think of them as three armies against nature".

"Every time I want to get on with my work, I'm summoned to one more bloody committee. If any problem arises here, somebody will say, "Well, we'd better have a committee about it". Why dont people decide anymore? What are bosses for? If I want to get a bit of policy thinking done I have to take the problem home and do it in my spare time. There's no time for action in working hours - only for activity".

A "keen young technical executive"
quoted in "The British Engineer" March, 1965.

Letters to the Editor

(Pseudonyms are accepted provided the author's name is known to the Editor.)

Sir,

In the February ORBIT when discussing the intergration of NIRNS into the SRC you gave readers the benefit of a chart with a "You are here" arrow. I guess there are no prizes offered for the position of a similar arrow on the charts in the April issue. Perhaps you will be able to indicate where it should be - surely not where it seems to be implied on Page 5 ? Rumour has it that the Atlas Laboratory comes under the Science and Technology Division.

I cant make the sums come out right either. The six establishments comprising SRC you list as -

RHEL	approx. 1000 strong	approx. 47% of SRC
DNPL	250	12%
Atlas	70	3%
Greenwich	200	10%
Blackford Hill	70	3%
Radio Research	270	13%
London Office	240	12%
	2100	100%

Then you quote John Davy as saying that the U.K. spend about £10 million a year on nuclear physics now (including CERN) and you also say the SRC Budget is about £28 million. When one considers that nuclear physicists equipment is rather more expensive than administrators it does appear that the RHEL budget is on the low side, to say the least. Can you correct my ignorance please ?

E G Higgins

The relationship of the Rutherford Laboratory and London Office was indicated in the note from Dr. Pickavance which was circulated on 17 May. We will not therefore repeat this information, (or details such as the membership of the Nuclear Physics Board which accompanied the note) in ORBIT.

It is difficult to know what is included under figures like the £10 million quoted by John Davy. (It probably means £6m at RHEL, £1¾m at DNPL and £2¼m at CERN and does not include research grants to Universities etc...) The "Civil Estimates 1965-66, Class VII Education and Science" gives a detailed breakdown of the SRC budget. The total is £28,476,000 divided roughly as follows -
SRC £23½m, CERN £3m, ESRO £1¾m, NATO £¼m. Of the SRC figure the Rutherford Laboratory has £5m for general expenses and £1½m capital expenditure. University grants top £6m and post graduate training awards £4m - Some of this is effectively expenditure on research at the Rutherford Laboratory. Ed.

Sir,

With reference to your editorial comment in 'ORBIT' Number 34, April 1965, "A happier situation has been reached...a mutually agreeable compromise has emerged from negotiations on the shift system issue" We the undersigned, being Duty Officers on NIMROD, wish to correct

this misleading statement. We are sure that it was unintentional on your part.

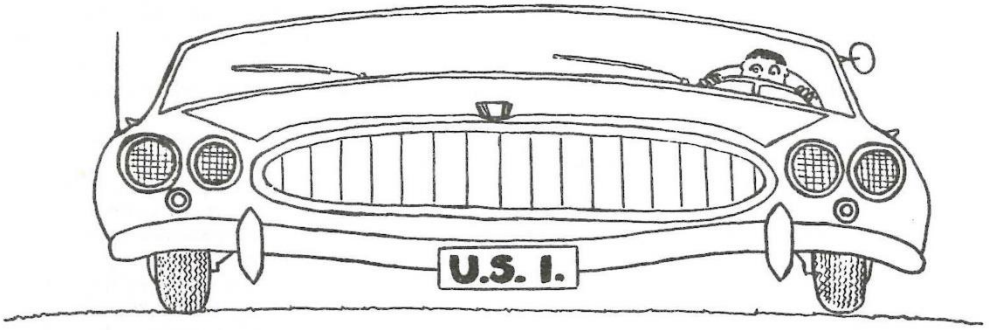
The Engineers and Technicians on the NIMROD and PLA crews are being compelled to work an 8 hour shift system instead of their preferred 12 hour system. This decision has not been negotiated or agreed.

Following the decision, approaches were made by the staff side and a concession has been granted to allow 12 hour working at the weekends to reduce the incidence of weekend crewing. This and this only has been negotiated and agreed between the Official and Staff sides. The Laboratory as a whole must not be misled about this issue.

E HARTLEY
J R CLARKE
V C CLOKE

B BOARDMAN
F S GILBERT
A LUBBOCK

American Cars Are Different



Harold Wroe's first "Letter from American" has arrived. Significantly it is about one of the symbols of American life - the automobile. Last year General Motors made their biggest profit yet - $1,750 million (ten times the expenditure on high energy physics.)

Life at Brookhaven without an auto (car) is practically impossible and so Arie van Steenbergen very kindly offered to lend H his old car for the weekend.

"It's a heap," said A, "but it's better than nothing. My wife will be driving past the Lab. on Saturday morning, why don't you come back to our place with her and then you can drive the old Ford back?"

"Fine," said H confidently.

When they arrived at A's house, the Ford was standing outside and didn't look bad at first sight - the fenders were still on and there were only a few rusted holes in the body. "I'll drive you round the block first," said A, "then you'll see what it's like. The exhaust system isn't too good so I would keep the windows open. Everything else works but the motor tends to stall, so if you have to stop for any reason, pull the choke out a bit." When H tried to get into the car, the door didn't seem to open properly.

"Just pull hard," said A.

A great heave opened the door and pulled away a panel in the off-side front wing, which then snapped back with a loud clang. Once behind the wheel he was suddenly aware of the huge size of the car compared with the British models, the width in particular being tremendous. He tried the main controls and discovered that the hand brake was very slack.

"Oh, the hand brake doesn't work, I think," said A.

"How do you stop on a hill then?"

"Who wants to stop on a hill? I've never stopped on a hill. Just leave the car in bottom gear!"

"Is there any legal requirement to test an old car, like there is in England?"

"Oh sure, this car is tested every year."

Reassured by this, H set off to the Lab., narrowly shaving a line of parked cars, his nearside judgment not yet adjusted. After a few miles he was gaining confidence when he came to the first intersection (cross road) at which he had to make a right turn off the highway onto a country road, and, remembering about the choke, he pulled the knob on the dash board but it came away in his hand. The corner was rapidly approaching and he tried a few more knobs, one of

which started the wipers, and then gave up in order to concentrate on the unfamiliar steering which was very low geared. The result was a bad right turn which ran wide and H was aware of mildly curious glances from passing drivers - one of the knobs he'd just pulled must have put on the headlights. When the car was back on a straight line, H realised that the first knob was the cigarette lighter and he was still clutching it in his right hand (no wonder that steering had felt awkward).

A bit further on there was a long straight stretch and another vehicle appeared in the distance, bearing straight down on the Ford.
"What on earth is this chap doing," thought H in alarm, "He's coming straight at me!...Hells Bells it's me!! I'm on the left hand side of the road!! You should be on the right, you fool, pull over!"
After a violent swerve to the right, H noticed some signs flashing past. "What do they say? Speed limit 35 m.p.h. You're doing 65 man, slow down!"
He pressed the brake pedal but nothing happened.
"Press harder, PUT YOUR FOOT DOWN"
He was nearly thrown through the windscreen as the car shuddered to a stop with tyres screaming.
After restarting, the car was made to proceed in a reasonably controlled manner until H found himself moving along the William Floyd Parkway and the green signs for the right turn to B.N.L. were showing up.
He thought he was home and dry. Up ahead was the traffic light suspended on it's cable across the intersection and he saw that it was showing green.
"Ah, now it'll be red by the time I get there so I must get organised with the choke and brakes."

However, out of the corner of his eye, he saw another sign saying 'Keep right for Brookhaven National Lab.' and he realised he could filter right and ignore the traffic light. Looking in the rear view mirror he was amazed that he couldn't see the road behind - it was just a blank! The boot lid had sprung up, probably due to the violent braking a few miles back, - the back window was completely covered and he had no idea if there was a vehicle behind. Hoping for the best, he operated the right hand trafficator and swung into the slip road in the nick of time, winding the wheel round violently because the curve was tighter than it looked and he was going a bit too fast again. In his haste he kept grabbing the horn ring so that loud blasts sounded out and then a series of nerve shattering explosions took place underneath the car.
"Backfires!! Of course - the choke! Pull the choke out man!"
He pulled the choke right out and depressed the clutch pedal and the engine sprang to life again with an ear-splitting roar, like a squadron of Superfortresses taking off with a full bomb load.
Wiping the sweat from his eyes, he pulled off the road to close the boot lid, remembering to put the car in bottom gear and switch off the engine. Unfortunately, he did'nt wait for the engine to stop before releasing the clutch pedal and the car jerked forward causing him to bang his head against the door pillar in getting out. He had stopped against a sign saying 'No parking on the pavement except in emergency'
Well this was an emergency all right.
Some time after reaching his apartment, the phone rang.
"It's Arie for you," said Mrs. H.
"How did you make out?"
"Fine," said H, "no trouble at all".

The "working week" for non-industrial staff will shortly be reduced by an hour. Members of the various staff associations were asked in a survey how they would like to see this applied. The results of the survey have been: (a) the hour should be taken off intact and not divided throughout the week (b) the hour should preferrably be taken off Friday (c) failing that, the hour should be taken off Thursday. The results have been passed to management for decision.

We were passed some of the comments from the survey:-
"Charge for car parking facilities if the people in question could conveniently travel by ATS. This will encourage the people to use the ATS and make it more profitable as well as decreasing congestion at outmuster times".
"Any scheme which entails later starting in the morning should be strongly resisted. This is additional leisure time not "lay-in time"

"A road through East Hendred from the Didcot area would release the pressure on the A34 and Rowstock Crossroads. This would reduce the annual mileage of AERE transport quite considerably with a consequential cash saving which would soon repay the capital cost and improve efficiency all round"

"Two hours off each Friday would really mean that one could go to Oxford shopping or get down to some serious gardening"

"Make major improvements in traffic congestion problems, i.e. a road to Hendred and a dual carriage way outside the site with an underpass"

"Starting time should be constant. There is too little time in the mornings for considering what day it is. It would involve resetting alarm clocks etc., and one tends to wake up at a regular time"

Orbiting Around

Editor: H F Norris
Building R20, Ext.484.

Lord Bridges KG

CAGEY?

It was announced on 23 April 1965 that one of the vacancies in the Order of the Garter had been filled by the appointment of Lord Bridges as a Knight of the Garter. Lord Bridges was the chairman of the National Institute for Research in Nuclear Science from 1957 until its dissolution in the reorganisation of science on 1 April this year. The Most Noble Order of the Garter, the premier order of Chivalry was founded by Edward III in 1348 and is limited to 26 members, apart from members of the Royal Family and honorary foreign members. Appointment is in the personal gift of the Queen. We send our congratulation to Lord Bridges.

SRC Staff Side

The committee members of the S R C Staff Side of the Whitley Council and the Institution of Professional Civil Servants Branch are:

SRC Whitley Committee

A H Spurway - Chairman - IPCS
L Linge - Secretary - CSCA
Ordinary Members:
7 from IPCS 1 from AGSRO
3 from CSCA 1 from STCS
1 from SCS 1 from CSU

IPCS - SRC Branch Committee

A H Spurway - Chairman (Rutherford Laboratory)
J H Aram - Vice Chairman (Rutherford Laboratory)
Miss J Penny - Secretary (Royal Observatory, Herstmonceux)
R Morgan - Assistant Secretary (Rutherford Laboratory)
E Golton - Treasurer (Radio and Space Research Station, Slough)
Ordinary Members:
G L Cooper (SRC Headquarters - previously at the Rutherford Lab.)
A Lubbock (Rutherford Laboratory)
G Snow (Daresbury Laboratory)
P Bradley (Radio and Space Research Station, Slough.
H Bevan (Radio and Space Research Station, Winkfield)
Dr G Wilkins (Royal Observatory)

More addresses - "Rutherford Hel"; "National Institute for Research into Nuclear Laboratories" and, from someone who wanted the best of all possible worlds "U.K.A.E.A., N.I.R.N.S., Chilton, Harwell, Berks.

Cricket

A very enjoyable game was held on Monday evening, 10 May, between PLA and Nimrod in the first match in Division I of the Evening League. PLA won the toss and decided to bat first. John Pilcher, the PLA Captain and Harry Jarvis opened the batting and made a very useful opening stand with John scoring 27 and Harry 29. The rest of the team fell quite cheaply and the PLA were all out for 78, thanks to some very good bowling by Mick Woods (4 for 22), John Moir, Mick Marcus and Dominic Medar.

The Nimrod innings was opened by Ray Smith and Barry Briscoe and with some very powerful hitting (each one hit a six) runs came very quickly, 50 runs were on the board after 6 overs. Barry was eventually bowled by Harry Jarvis for 32, Ray carrying his bat for 33 Not Out. He was also well supported by Ken Gregory (14 not out) resulting in a fine win for the Nimrod team.

B Goodenough

(Barry Briscoe took over as the Nimrod team wicket keeper for the first time and, having frightened himself and everyone else, held 2 catches. Which all goes to prove something. Ed.)

Rugby

Withdrawals at the eleventh hour obliged the Laboratory to field a hybrid team in the Harwell 7-a-side tournament, held on 2 May. The final complement was Jim Homer (Nimrod Beams Physics Group) Nevill Jones (HEP Group)., John Harrison (Electronics) and Dave Gibbings (Nimrod Machine Physics Group)., from the Laboratory, supplemented by a further three players whose original intentions had been merely to watch (sounds like the Army game of "Volunteers" Ed). With this array of talent we managed to win a place in one of the semi-finals by beating "Metallurgy" and Apprentices II" in the preliminary rounds. However, our opposition in the semi-final "Engineering", proved a little too strong for us and we lost 8-0 after a hard open game full of good rugby.

The eventual finalists were "Engineering" and "Culham" with the latter finishing up as the victors of the tournament.

D Gibbings:

Laboratory Open Day - June 19

The Laboratory will be open during the afternoon for members of the staff and University visitors, their families and friends.

The main feature will be a wide range of scientific and engineering exhibits which should always interest and occasionally mystify.

In addition, a programme of races is being organised for the children; a range of sideshows will be set up to amuse all ages and possibly make some money which will be set aside for recreational purposes; and finally, tea to revive before the journey home.

Watch out for a Rutherford Laboratory Circular giving details of the arrangements.

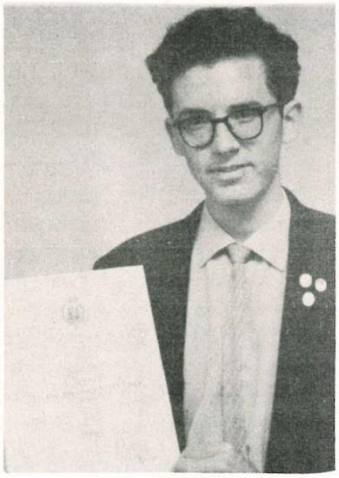
Editorial Board

Derek Moore from Nimrod Machine Engineering has succeeded Ted Higgins, Central Engineering Group, on the Orbit Editorial Board.

Back to Risley

Arthur Fryer returned to Engineering Group, UKAEA, Risley on 3rd May. He joined Risley in 1951 and was seconded to AERE for 2 years in 1958. Amongst the various projects with which he has been associated during the past 7 years have been Nimrod and other buildings in the Laboratory as well as work for both Harwell and Culham. During the past 12 months he has been assistant to the Chief Engineer, Mr. Bowles, and has looked after Engineering Training in the Laboratory. Although he has returned to Risley, he will still pay regular visits to the Rutherford Laboratory. Arthur has "mixed feelings" about his return to Risley although he feels it will be nice to know he is settled in one place.

Gold Standard



The photograph shows Graham Waters, with the certificate he received from the Duke of Edinburgh at Buckingham Palace on 11 May. This certificate is awarded to boys and girls who have attained the "Gold Standard" of the Duke of Edinburgh's Award, and about 6000 have received it so far. Graham who entered the S.A.'s school in September, 1964, joined the PLA Accelerator Physics Group last December. He obtained the bronze silver and gold medals of the Award whilst at school at the Wheatley Hills Boy's School, Doncaster. The scheme is split into three series of tests with four sections in each series with, of course, the highest standard in the third series, leading to the Gold Medal. Each series contains sections on Rescue and Public Service Training, The Expedition , Pursuits and Projects, and Fitness. Amongst Graham's achievements were:- 3 miles road walk in 30 minutes 55 seconds, a 17 foot long jump and a 50 mile journey in the Peak District covered in 2 days with 3 nights at different camp sites. (I suspect that the Palace reception was probably the toughest assignment of the lot. Ed.)

Laboratory Dance — 19 June

A dance will be held in the restaurant on the evening of Open Day. The organisers aim to provide a really good band with a wide appeal, a bar and buffet at reasonable prices, and transport from and to nearby towns.
Note the date - 19 June.
Any profit will be set aside for recreational purposes.

Comings and Goings

R J Beswick and D J Foreman join H.E.P. Counters Group;
R T Nickson joins Nimrod Beams Physics; S H V Randall joins Nimrod Machine Engineering.

B W Cummins and I Green join Applied Physics Bubble Chamber Group; B Faldrowicz joins P.L.A. Accelerator Physics Group; H J Jeanes joins Central Engineering; W J George joins General Administration.

D Evans, C R Knowles, (Dip.Tech.Students) have returned to the Laboratory for their industrial training period of six months.

J F Crawford, J R Lanning, Mrs. J. Lidbury, T J Prior, N Vigeon, F J Burden and A W Harvey have left us.

Congratulations to -

Anne Rimer, General Administration - Atlas Laboratory, and Robin Kearvelle on their engagement on 7 May.

Christine Snow, General Administration - Applied Physics Division, and Alan Wilson, Institute of Economics and Statistics, Oxford (also recently of Applied Physics recent engagement.

Suggestion Awards

At the twenty -sixth meeting of the Suggestion Awards Committee, held on Wednesday, 5 May, 1965 the following awards were made:

£2 10s 0d to A V Wells whose proposal to use expansion joints on Building R50 had proved to be successful.

An interim award of £1 was made to G Beckwith whose modification to Scintillator Box Assemblies will be adopted. The suggestion was being investigated further.

An encouragement award of £1 was made to T Stewart.

B Briscoe, Secretary:

Record Programmes

The programmes for June, to be held in the Lecture Theatre at 12.30 p.m., are as follows:

1 June	Nielson 'Maskarade' Overture Sibelius Symphony No.3
15 June	Brass Bands Music from the Royal Military College of Music and the Royal Marines Bands.
22 June	Duke Ellington The music the Duke wrote for the film "Anatomy of a Murder"
29 June	Light Music Selections from "My Fair Lady" and "The Merry Widow"

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