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STAFF ASSOCIATION

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The other side of CERN

The British Government has decided to review the UK's participation in high energy particle physics. This will be carried out by the Advisory Board for the Research Councils (ABRC) and the Science and Engineering Research Council (SERC) under the chairmanship of Sir John Kendrew.

The proposed terms of reference for the review are :

"Having regard to the long term health of British science and engineering research and to the Common Criteria for the support enunciated by the Advisory Board for the Research Councils in its Second Report, 1974-1975 :

- i. to review UK participation in the study of high energy particle physics, with particular reference to that necessarily carried out under international auspices ;
- ii. to consider possible future involvement, the role and extent of international collaboration, and the implications of reallocation of the resources in whole or in part to other areas of science ;

- iii. to report to the Chairman of the ABRC and the Chairman of the SERC."

Clearly the review group must question the continued participation of the UK in CERN and, already, they have arranged to come here on a fact-finding visit.

With these events in mind the Staff Association has decided to publish the following article which appeared in the 7 June issue of the New Scientist. It was written by Derek Imrie (Chairman of SERC's Subcommittee on Particle Physics) and John Walsh (UK delegate to CERN's Finance Committee) and is reproduced with their kind permission and that of New Scientist.

The purpose of the article is to remind not only Britain but all the European countries that CERN has much more to offer than the particle physics results for which it is already world famous.

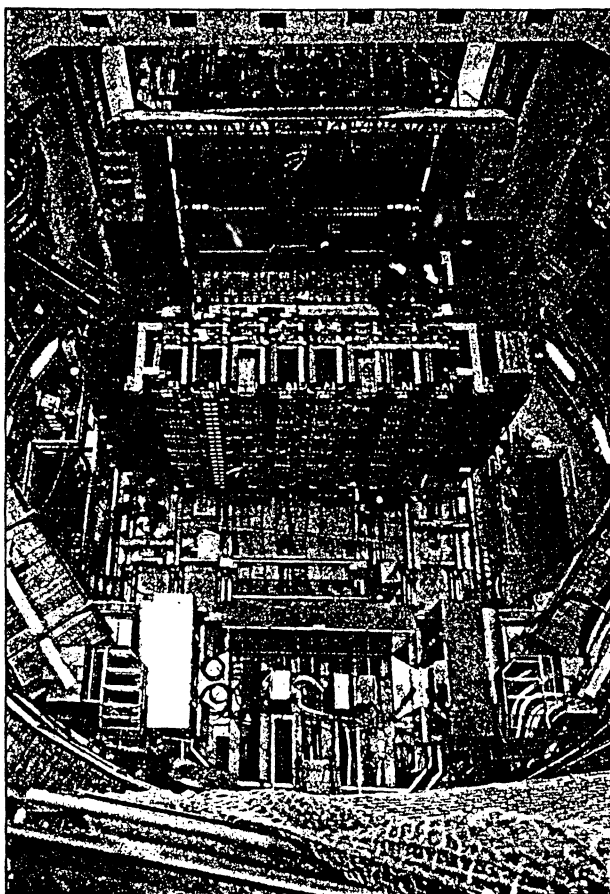
CERN is well known as Europe's centre for particle physics. But its involvement with R&D in other fields, the business opportunities it offers, and its educational programmes are less familiar. These are CERN's "other side"

Derek Imrie and John Walsh

FROM THE Jura mountains in south-east France on a clear day you can see right across Geneva to the Alps and Mont Blanc. But there below you lies CERN, the European centre for research in particle physics, a monument to European cooperation that straddles the Franco-Swiss border. CERN is the phoenix that rose from the ashes of European science after the Second World War, when the continent's researchers had been flung far and wide to escape persecution or to work for governments on the atomic bomb. Now the laboratory has a number of "firsts" to its credit, including most recently the discovery of the W and Z particles that transmit the weak nuclear force. CERN has also come to symbolise an example—perhaps the only example—of a European collaboration that works. But it has more to offer than its fame in particle physics may at first suggest.

When, in the early 1950s, several leading European scientists, encouraged by UNESCO, came to consider a project suitable for collaboration, the field of particle physics (or nuclear physics as it was then called) was a natural choice. The research requires high-energy particle accelerators, and it makes good sense to share the cost of such large facilities among several nations. The European Organisation for Nuclear Research came into being in 1954. Now it is better known by the original acronym CERN, which stands for *Conseil Européen pour la Recherche Nucléaire*, that was dissolved on the formal founding of the Organisation.

Today, 13 states are members of CERN and contribute to its budget in approximate proportion to their GNP. Belgium, Denmark, France, West Germany, Greece, Italy, the Netherlands, Norway, Sweden, Switzerland and the UK were all founder members of the organisation, along with Yugoslavia which subsequently withdrew. The other member states at present are Austria, who joined in 1959 and Spain, which joined in 1961, withdrew for financial reasons in 1968 and rejoined last year. Several other countries have formal or informal links with CERN, including Canada, China, Japan, the US and the USSR.



UA1, one of the experiments at CERN which found the W and Z particles last year

CERN's primary task is to construct and operate world-class high-energy accelerators for its users. During its first 20 years, the establishment grew steadily as its accelerators increased in number and power. The original small site on the Franco-Swiss border near Geneva was enlarged in 1965 when the Intersecting Storage Rings (ISR) were constructed. These were two interlaced rings of magnets designed to store counter-rotating beams of protons and bring them together head-on to produce what were for over a decade the highest-energy particle collisions in the world. A second site in France was added in the early 1970s when the 7-km ring of the Super Proton Synchrotron was built. This accelerates protons to 150 times the energy of CERN's original proton synchrotron.

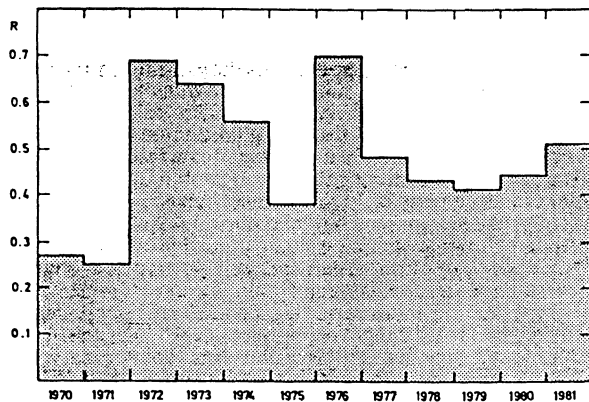
During the past decade, CERN's budget has declined steadily in real terms and is now around 80 per cent of its peak in 1974. It is currently some £220 million. The organisation took a considerable gamble in 1981 when it decided to construct its next accelerator, its largest ever. This machine, the Large Electron Positron Collider

(LEP), will have a circular tunnel 27 km long, stretching out from the existing site under the Jura. It will collide electrons and positrons at energies almost double those reached by existing similar machines. By dint of strict economies in other programmes, closing the ISR while the device was still producing excellent results, and cutting its staff, CERN expects to be able to complete the first phase of LEP by late 1988, within the original cost estimate of £325 million. Needless to say, in these difficult times the prospect of a constant budget has proved illusory; the budget has in fact fallen in real terms by a couple of per cent, though the rate of decline is less steep now than it was in the late 1970s.

There are now just over 3500 staff at CERN, serving an ever-growing community of more than 2600 users from around 200 different institutions. Nearly half the CERN budget is spent on salaries and other personnel costs, and nearly half the remainder on utilities and on contracts for items that must, inevitably, be purchased locally in France

and Switzerland. As a consequence, the money available annually to purchase materials and equipment, for which all member states may reasonably hope to compete, is about £60 million; much of this will be for items for LEP during the machine's six-year building programme.

CERN awards contracts after competitive tender among firms in the member states; the net is cast wider only if no firm in a member state can supply a particular item. Competition is usually severe, because firms recognise that



Britain's return ratio: the fraction of CERN's purchases secured by the UK/the UK's fractional contribution to CERN's budget

supplying CERN brings a variety of benefits. CERN is a valuable "shop window" for advanced equipment, and securing a contract carries the implication that the successful tenderer must be among the best in its field in Europe. A study in 1975 of the knock-on effect of CERN contracts showed that, on average, £100 000 of sales to CERN generated £420 000 of sales elsewhere; surprisingly, perhaps, most of these were to areas outside particle physics. A contract will often require a firm to develop a product or process to a new level of performance. CERN will pay a fair price for the development and may even provide expert assistance.

The past performance of the UK in gaining CERN contracts has been rather mixed. A measure of a country's performance in this respect is the "return ratio", the percentage of CERN's total utilities and materials budget gained by firms in the country, divided by the country's percentage contribution to the CERN budget. As half the budget goes on salaries and so forth, this ratio should be 2 if all of a country's contribution to the CERN budget is being returned by way of industrial contracts. The non-host states have an average return ratio of about 0.5. A few of the smaller ones manage to achieve a ratio of 1 in some years. Only Switzerland consistently scores an average greater than the magic figure of 2.

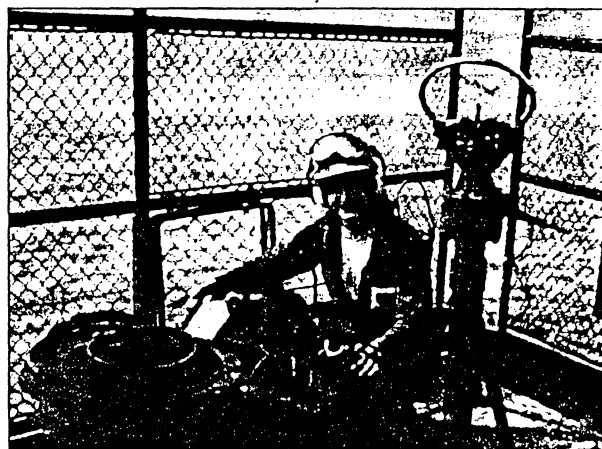
The UK contributes 16.1 per cent of CERN's budget at present; although the UK's return ratio of around 0.5 is quite creditable, there is little doubt that it could do better, given its relatively broad industrial base. As the Figure shows, in the early 1970s, when the SPS was being constructed, it regularly reached values between 0.6 and 0.7. Distant member states are likely to do better when a major project is underway, because large, one-off contracts are on offer, rather than a mass of routine purchases. So far, the UK's performance has not shown the increase one might have hoped for with the LEP project. In some project areas, firms in the UK have done very well; sound preparation has led to competitive tenders. Elsewhere, tenders from Britain have been embarrassingly high by comparison with the average, indicating a lack of international competitiveness, or, possibly, an over-conservative approach to costing research and development activities.

Although one naturally thinks of CERN in terms of high technology—superconducting magnets, high-vacuum systems, electronics, microprocessors, high-speed data links, and so on—a glance at the list of suppliers from the UK during 1983 reveals some surprises. Hidden among the specialist firms are a high-street department store, which provided many of the furnishings for a new hostel, and a well-known academic bookseller, who supplied many of the specialist monographs purchased by the CERN library.

Looking to the future, LEP and its associated experiments will require large quantities of electronic circuits controlled by many microprocessors and minicomputers. The UK's acknowledged expertise in hardware and software should put it in a strong position to gain contracts in these areas.

The Department of Trade and Industry has recently set up a Working Group under the aegis of the British Overseas Trade Board to inform British industry of the business opportunities available at CERN, and to offer legal, marketing and shipping advice. The Working Group aims to increase the UK's ratio of return to around 0.75. If it succeeds, an additional £3 million per annum of contracts from CERN will be won by firms in the UK.

It is not an exaggeration to regard CERN as one of Europe's foremost technical universities—a "European MIT"—whose facilities operate 24 hours a day, seven days a week, for most of the year. Each week there are courses and seminars at a variety of levels. Industrial firms call regularly with travelling exhibitions, and larger exhibitions from the countries involved in CERN are mounted two or three times per year. The constant ebb and flow of users and visitors provides both



Now a petroleum engineer with BP in Aberdeen, Karen Gregson spent a year of her sandwich course in applied physics at Bradford working at CERN as a technical student on an electronic system to emulate an IBM mainframe computer. In her opinion, "CERN is an excellent environment for a young person who is going to work in industry"

changing audiences and new speakers. Just as in other fields, today's creative innovation is tomorrow's routine application, and a new development by one group of experimenters spreads rapidly to others and to their home institutes. The discovery at CERN of the W and Z particles—important participants in the weak nuclear interactions—is a striking example of a development that had lecturers throughout the world revising their undergraduate lecture courses within days of the results being announced. There are many examples in other fields that illustrate the rapidity with which discoveries and technical developments at CERN affect teaching in universities.

CERN provides a variety of opportunities for scientists

and technologists to spend significant periods of time at the laboratory. The Fellows and Associates Programme will pay salaries in full or in part for one or two years to permit graduate personnel to work in many areas of science and engineering. Each year, CERN appoints around 50 fellows on two-year contracts and around 150 associates for shorter periods. The UK fills at least its fair share of these posts, despite severe competition. During the past five years an average of 11 British candidates have been awarded CERN Fellowships each year.

At any time, there are about 200 experimental particle physicists in the UK who are students working for a PhD, or post-doctoral researchers with short-term appointments and spend some time at CERN, either on short visits while their experiment is operational, or for longer periods to set up an experiment, develop equipment or analyse data on the CERN central computers. CERN is an excellent environment for younger staff, owing to the broad spectrum of technologies to which they are exposed, and because all experiments are performed by large, international collaborations. The discipline of working in a multinational team and of learning to produce work on a timescale dictated by the needs of the collaboration is possibly the most important aspect of the training.

There are also two programmes at CERN for undergraduate students. The Technical Students' Programme allows 40 engineering and applied science undergraduates per year to spend between 6 and 12 months on industrial training at CERN. British universities and polytechnics offering sandwich courses have made excellent use of this scheme; since 1976 more than 100 undergraduates from the UK have worked at CERN for the part of their courses where they must spend time in industry.

CERN also organises an annual Summer School for

around 100 undergraduates. The students remain at CERN for between one and three months, attend lecture courses and join in the work of one of the divisions. The shortness of British undergraduate courses by comparison with those in other member states means that undergraduates are encouraged to attend the Summer School after completing their degree, which undoubtedly dissuades some who wish to take up employment immediately after graduating. The fact that demand from well-qualified British graduates always substantially exceeds the number of places on offer illustrates the quality of the scheme and the esteem in which it is held by the students.

Finally, CERN takes seriously its duty to inform ordinary members of the public about its activities. A variety of pamphlets and other descriptive material is published by the Information Service, and there are guided tours for visitors. A most testing experience for a young graduate student is to find his experimental control room invaded on a quiet Saturday afternoon by a party of 30 to 40 French pensioners, and to be asked by the tour guide if he could possibly explain briefly, in French naturally, what he is doing and why!

CERN's "other side" is part and parcel of its role as a large, international research laboratory, and a good example of the principle that expenditure on "big science" can be expected to provide a broad range of technological, industrial and educational benefits. Perhaps the best commentary on CERN's activities was provided by a distinguished British visitor who, comparing CERN with other European foundations, is alleged to have remarked, "The difference is, this place works!" □

Dr Derek Imrie is reader in physics at University College, London, and chairman of the SERC's Subcommittee on Particle Physics. John Walsh is in the SERC's Head Office in Swindon, and is UK delegate on the CERN finance committee.

CLUBS

YACHTING

Résultats de la Régate du 7 juillet 1984.

Organisation : J. BUCHENBACHER et W. KLEMP
Surveillance : RODEL/RODEL et TALBOT/TASWELL

Dériveurs

	Bateau	Temps		rang
		réel	comp.	
STEPHEN/WOTSCHAK	485-7	2h42	2h37	1
CHARENTREUIL/BOUILLEU	Caravelle	3h41	3h00	2
HAGELBERG/HELLMAN	420-2	3h30	3h02	3
ROCHEZ/RAY	420-3	3h42	3h13	4

Lestés

SCHUT/SCHUT/VANDOOREN	Blackbird	2h24	2h18	1
BOIMOND/WAELCHI/ROSA	Comet 850	2h27	2h27	2
HENRICHSEN/SWOBODA	Bianca 28	2h44	2h35	3
THOLLE/THOLLE	Sangria	2h57	2h47	4
CANIAC/CANIAC	Meteor	3h24	3h24	5
KOBRIK/LECLERC/				
GASE-BONDA	Kelt 8	3h24	3h25	6
STUDER/STUDER	Vega	3h41	3h41	7

Planches à voile

HOYER	Alpha	1h14	1
TURNER	Alpha	1h18	2
HEINZE	Fanatic	1h28 ⁺	3
FOCKER	mistral	1h39	4

CRICKET

On Sunday, July 8, Geneva C.C. were the visitors in the second of three matches played over the season between the two clubs for the John Harvey Trophy, which is at present held by CERN C.C. In perfect weather conditions the match developed into a closely-fought tussle. Geneva C.C. lost three early wickets, but a forth-wicket stand of 60 saw them to a respectable total, despite a late rash of tumbling wickets. CERN C.C. lost wickets rapidly at first, but from 30 for 6 held out for a draw with finally less difficulty than might have seemed possible at an earlier stage. Scores :

Geneva C.C. : 113 all out
CERN C.C. : 84 for 7
Match drawn.

Since CERN C.C. won the first match of the season this results means that whatever the outcome of the third match, which is due to be played on July 22 (CERN C.C.'s next match), CERN C.C. retain the John Harvey Trophy for 1984.

Net practice is held on Thursdays from 17.30 at the SPS pitch.

Assiduous cricket fans are hereby advised that due to the holiday period there will be no practice on July 26 or August 2, i.e. practice as usual on July 19 and from August 9 onwards.

Anyone interested in cricket is welcome to call 2923 or 2655 for further information.