LIVING AND WORKING AT HARWELL

The following observations are those of an American who has spent the past year in England as a visiting physicist in the laboratories of the Atomic Energy Research Establishment (Harwell). An undertaking of the United Kingdom Atomic Energy Authority, the AERE is located near the village of Harwell in rural Berkshire, fifteen miles south of Oxford and fifty-five miles west of London. The author, who returned to the United States in September, is a senior physicist at the Argonne National Laboratory.

By ***Alexander Langsdorf, Jr.***

THE giant but youthful research laboratories in England and Europe are much less well known to Americans than the great foreign universities. This situation is changing as an increasing number of American physicists are making extended visits to laboratories such as Harwell, in England. The movement is made possible by the world-wide relaxation of security restrictions in the "basic" sciences, reactor engineering, and thermonuclear research as well as by the removal of classified work to separate sites. Today Harwell, for one, directly employs non-Commonwealth scientists including Americans while other visitors are "attached", meaning on leave from their regular posts and not paid by Harwell. And I should say at once that the enthusiasm of Egon Bretscher, head of Nuclear Physics, has sparked many visits to Harwell by American physicists.

There is no use pretending that scientific considerations alone lead one to abandon for a year both work and home in the United States; to live in England is an attractive and appealing prospect for the entire family. I want to describe first how well Harwell lives up to such expectations.

Upon landing in Southampton in July 1959 we were met by a car and driven over the rolling green fields neatly divided by hedgerows to Buckland House, an eighteenth-century manor house maintained by Harwell for guests. Set in an idyllic and ancient park land with adjacent deer park, and nearby to the thatched-cottage village of Buckland, it is an impressive introduction to one aspect of traditional British living and one not often experienced by visitors. Housing in this part of England is not easy to find and the Harwell authorities deserve great credit for the hospitality offered upon arrival and for help in finding permanent quarters.

We rented a house in Abingdon, an old town (predominantly seventeenth century in architectural style) of 13 000 inhabitants on the banks of the Thames seven miles north of Harwell. Many of the scientific staff of the laboratory live in Abingdon in housing maintained by Harwell; others live in surrounding villages and towns which retain a great visual charm which is a pleasing contrast for Americans accustomed to the unaesthetic appearance of their own towns. When at home in Abingdon I often saw magnet sections for the 7-Bev synchrotron under construction at Harwell being trucked through the narrow twisting streets of the town. The fascinating contrast of modern and old made me remember that this was where modernity originated. It

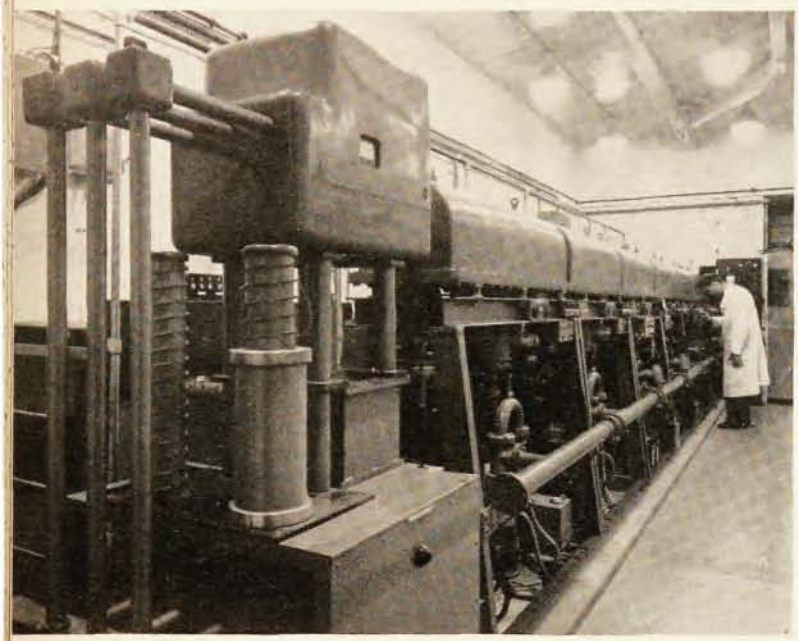
Some of the physicists on working visits to Harwell, assembled on the lawn just outside the vertical tandem electrostatic generator building. Left to right: L. Katz (Canada), K. H. Lokan (Australia), D. S. Gemmel (Australia), S. A. Durrani (Pakistan), D. W. Mingay (South Africa), A. Langsdorf (US), A. B. Whitehead (Canada), M. J. Scott, E. C. H. Silk (South Africa), R. L. Macklin (US), and C. D. Moak (US). John S. Fraser and John P. Schiffer were on trips and unable to be present for the photograph.

was easy to forget how industrialized England is when living in an essentially rural oasis in the middle of the country.

The entire south of England is easily accessible from Harwell: two hours by car to London, the south coast, and Wales. Possibilities for exploration, entertainment, and intellectual stimulation are endless: theater in Oxford, Stratford-on-Avon, London; abundant archaeological sites from all periods; cathedrals, churches, and Oxford colleges. I may sound like a travel agent but these are incomparable assets offered to visitors from the New World. I should add that Oxford is only fourteen miles away so that it is possible for a scientist to divide his time between the Clarendon Laboratory and Harwell as a few have already done.

The question of schools for one's children is crucial in considering a year's stay abroad and often cannot be answered until one arrives. The English system is very different from our own; it is more complex with more gradations than we are used to, especially in the age groups from 11 to 18. We arrived in early July and were still able to make satisfactory arrangements for our two daughters aged 11 and 14 in a convent school in Abingdon. They easily made the transition from their rural Cook County, Illinois, school and only needed tutoring in French to fit into the correct English form. They liked their school very much and wished to stay another year. Perhaps I can risk the generalization that if children are reasonably good students and one makes a serious effort to arrange the school year properly, it will be a very beneficial experience. I urge making inquiries and plans ahead of time if possible, even though it is most difficult to relate where one will live to the location of the desired schools, a problem for which the Harwell authorities have not found any simple solution.

HARWELL itself is steadily becoming more attractive to the eye, thus better matching the pleasant countryside around it, as the original airfield and early temporary buildings are obscured by landscaping and replaced by new construction. Most of the buildings lie in a mile-long crescent which follows the old airstrip. They are tightly grouped and it is usually a surprise to learn that they house about 6000 people. Five large hangars dating from the '30s are conspicuous on the crescent; they were the first buildings to be converted to research purposes. The most recent construction has burst from the confines of the crescent onto the open



Neutron time-of-flight experiments at Harwell involve a powerful pulsed neutron source consisting of an electron linear accelerator (shown in photo at left) in conjunction with a multiplying target assembly. Neutron flight paths around the linac can be seen in general view above, with "Dido", the heavy-water reactor, in background. Construction work on "Nimrod", Harwell's 7-Bev proton synchrotron, can be seen in progress behind linac building to the left.

UK Atomic Energy Authority photos

A. B. Whitehead (Canada), T. E. Cranshaw (England), J. P. Schiffer (United States), and H. J. Hay (New Zealand) in photograph taken after their widely acclaimed Mössbauer effect experiments, conducted at Harwell last winter.

airfield, giving a clear impression of booming research. A tall attractive structure houses the new vertical tandem electrostatic generator. Next to this is the new library building. A half mile further on, one cannot miss the 60-foot-high chalk pile formed during excavations for Nimrod (the 7-Bev proton synchrotron) and destined to be used as shielding. Against this tremendous mound one sees the complex of buildings which are part of the Nimrod project. Across the road is the 30-Mev electron linac (where I spent most of my time) readily identified by the long vacuum pipes laid out like spokes of a wheel from the modest building at the hub. Beyond this is a group of buildings dominated by two steel shells each housing one of the twin heavy-water reactors, Dido and Pluto. They are at the edge of the level field close to the open rolling downs which ring the area.

At least five other physicists from the United States were working at Harwell during my year there. Charles D. Moak (Oak Ridge) was adapting the von Ardenne duoplasmatron type of source to give doubly charged helium ions for use in an electrostatic generator. John P. Schiffer (Argonne) attracted attention for his part in work with a Harwell group exploiting the Mössbauer effect in radioactive iron to observe the relativistic gravitational shift of frequency of gamma rays. Mary Jean Scott (Bryn Mawr and Brookhaven) worked with the 5-Mev and 12-Mev electrostatic generators. She was recently married to Edward C. H. Silk and they will return to his home in Johannesburg where he will be a senior lecturer in physics at the University of Witwatersrand and she will be a research fellow at the same place. Arthur Roberts (University of Rochester) came to Harwell two years ago. In the near future, when the 7-Bev proton synchrotron of the Rutherford High Energy Laboratory is in operation, there will be increased opportunities for visitors in high-energy physics. There are, of course, numerous other visitors in other branches of science and engineering.

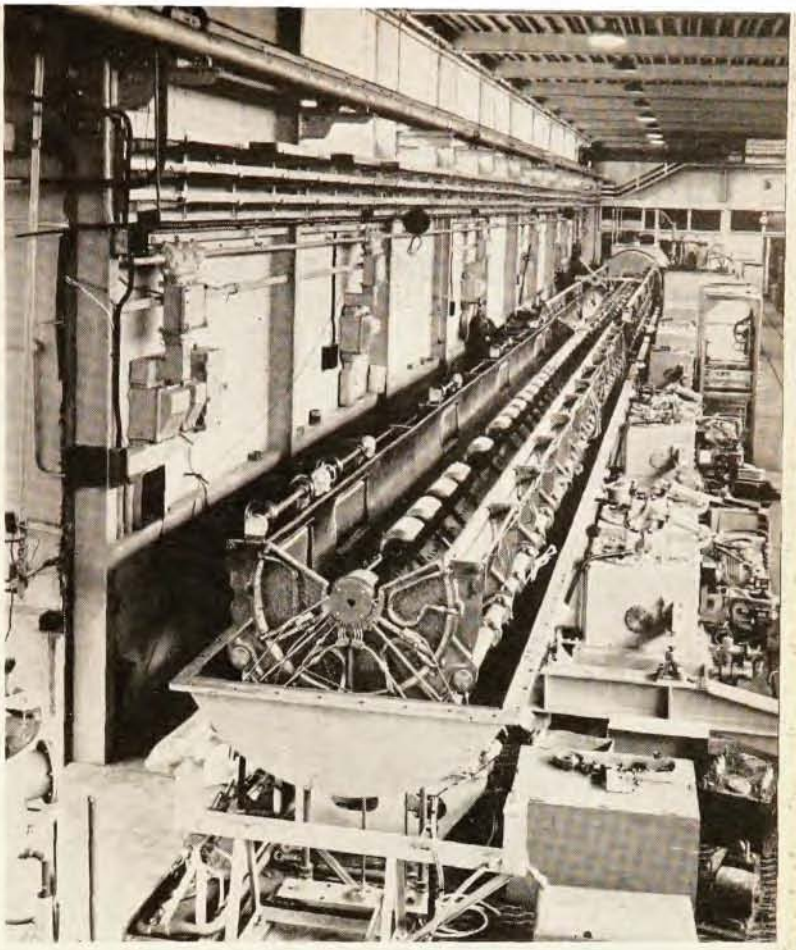
There are few laboratories with programs in neutron physics of extent and success comparable to that found at Harwell. As a result, among the myriad activities and projects underway at Harwell, neutron physics has perhaps attracted the most American physicists, myself among them. Other recent American visitors include

Robert Schwartz, now back at Brookhaven, who studied the scattering of neutrons by time-of-flight techniques, and Edward T. Melkonian from Columbia who made measurements of fission cross sections using the new semiconductor counters developed at Harwell as well as in the States. My own work with J. R. Bird and E. R. Rae was on the new electron linac, an intense source of neutrons for time-of-flight measurements. We studied capture gamma-ray spectra from resonance capture of neutrons. My co-worker Bird came from Australia and nearby were men from Australia, South Africa, and New Zealand. Canada was represented by Leon Katz (University of Saskatchewan) and John Fraser (Chalk River). Indeed, this Commonwealth mixture at Harwell is one of its interesting and rewarding aspects.

The development of the electron linac as a source of photoneutrons was initiated at Harwell shortly after the war in order to have a machine well suited to operate exclusively as a tool in neutron spectroscopy. The first 4-Mev machine was so successful that it was followed by a 15-Mev machine which originally operated at a time resolution of 2 μsec and competed effectively in time-of-flight neutron spectroscopy. Then construction was started on a more powerful 30-Mev linac, which was recently commissioned. Following the Harwell demonstration of the practicality of this kind of machine, similar ones have been installed at Saclay in France, at Yale University, and elsewhere. With a machine of this type it is practical to make measurements with many flight paths in operation simultaneously. At present there are at least seven major programs underway in neutron physics and one in gamma-ray spectroscopy, all using this newest Harwell linac.

A unique feature of this linac installation is a "neutron booster"—that is, a U-235 assembly which multiplies the primary photo-induced neutron burst by about a factor of ten. There is some question whether this kind of booster will be duplicated elsewhere because while construction of the new machine was underway the group using the older 15-Mev linac demonstrated that the electron pulse could be so limited and clipped as to give a resolution width of 0.08 μsec or less. This is much shorter than was known to be feasible when the booster system was designed. In any case, the new machine is adaptable and can be used with the booster when highest neutron yield is most important, or without the booster when the best time resolution is preferable.

The very idea of living for a time in a foreign country is a romantic one to many Americans, scientists included. Yet in the actual event, many of us tend to become overcritical of differences in manner of living and in attitudes toward comforts and conveniences, while in fact these very differences in living and thinking contribute to the interest and challenge of the experience. Furthermore, there is no question but that an extended visit to a research institution is a mutual stimulus to scientific endeavor. It also provides a broadening of perspective in one's view of the ever-expanding world-wide scientific community.



Above, 50-Mev proton linear accelerator in Harwell's Rutherford High Energy Laboratory. Below, photograph taken several months ago shows intermediate stage of construction on Nimrod, the 7-Bev machine also located in the Rutherford Laboratory. Nimrod, which has still another linac as part of its injection system, is expected to be in operation within a few months.