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Director

Nuclear Physics Research and Electronic Instrumentation

The inability of the Electronics Division to provide equipment for accelerators in time for their proper use has for years been a weakness with which Harwell has been beset.

The recent paper by Sir Donald Perrott, A.E.A.(58)6 on the Development and Production of Electronic Instruments within the Authority and the Functions and Future of the Electronics Division of the Research Group in this Field, which I had not seen and only heard of accidentally (but have now studied), led to a considerable amount of discussion between myself and Dr. E. B. Paul who is responsible for the liaison between the Electronics Division and the Nuclear Physics Division. Sir Donald's paper is inadequate in those parts which are concerned with the nuclear research side. To help Administration understand what is urgently needed, I have asked Dr. Paul to put the users requirements down on paper.

I hope you will feel with me that the expenditure of large capital sums on equipment without the auxiliaries for their use is very poor business economically.

I would like to propose that Dr. Paul's note be discussed in the first instance with yourself, the Head of the Electronics Division, Dr. Paul and myself, as a first step for further action, as soon as convenient to yourself.

A brief note pointing out the problem was sent to you by Drs. E. B. Paul and B. B. Kinsey on the 4th February 1958; there has been no reply.

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24th February, 1959.

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NUCLEAR PHYSICS RESEARCH AND ELECTRONIC INSTRUMENTATION

Research in modern physics tends to be thought of in terms of the large and expensive machines - reactors or accelerators. This is unfortunate but the reason is that this is where the initial large capital sum is spent. Unlike commercial enterprises the product of such expenditure is essentially unmeasurable since it appears in terms of new knowledge, better scientists, national prestige etc. What is sometimes not appreciated is that the scientific solvency of such a project depends completely on being able to extract readily the scientific facts from the result of the machine operation. In modern physics this means the electronic equipment one uses to detect, analyse and correlate the nuclear events. Other techniques are involved but on the score of relative simplicity and cost they are generally negligible compared to the electronics.

To build an accelerator without adequate provision for the electronic equipment to go with it can be compared to building a railway system with no provision for passenger stations or freight loading facilities. The electronics cost is large and is a continuing cost throughout the life of a machine. The machine is always producing controlled abnormalities in nature. As the physicist asks more and more difficult questions about nature he needs more and more elaborate electronics. How is this continuous flow of new electronics to be provided?

Ideally one would like to be able to buy all of this from commercial firms operating in a competitive market. In most economics this means selling some thousands of examples. But we have said that the electronics is to be used to ask new questions of nature. By the time even a thousand are sold the question is no longer new and the market for a research instrument may have disappeared. The next possibility is for small firms to be set up with fairly close links with the research organization (scientists on Board of Directors, research scientist moves to firm etc.). The development is then done in the research organization (such as A.E.R.E.) and the firm produces the electronic device on almost a non-profit making basis. This is widely done in the U.S.A. generally in association with a university department. It is more difficult for a public research organization to work in this way. The system is not economically sound or rather does not appear so since it is impossible to assess the results of the research. The final possibility is for the research organization to build almost all its own electronics. This is expensive and inefficient but since essentially all basic electronic development has been done at research organizations is inevitably widely practised.

Turning now to the case of the U.K.A.E.A. and Harwell the system has been a mixture of the last two approaches. For research electronics, the industry in the U.K. has lagged behind that of other countries in all but the most straightforward developments. For this reason it is inevitable in the foreseeable future that either the Electronics Division of Harwell must develop and build the lion's share of the equipment required or that as much as possible is bought from the U.S.A. The third alternative is to accept that physics research in the U.K. will never be at the frontiers of the subject. To keep at the frontiers of physics research it is necessary also to keep at the frontiers of electronics research. However the Electronics Division at Harwell has for some time been the 'poor relation'. To do the job outlined above it needs a status and strength approaching that of the Engineering Division. This is the ratio obtaining in productive university laboratories. The activities of the Electronics Division will be apparently a highly uneconomic one since the results of research are not included to balance the books. After all if their activities ever become economic commercial firms would be eager to take over the job.

Our Establishment's considerable scientific reputation in Europe and America is based on its scientific attainments in the past. If the supply of up-to-date electronic devices continues to deteriorate as it has done over the last few years this reputation could very rapidly be lost. Large and expensive accelerators which are not producing results are a bad advertisement. 100 channel pulse height and time analysers of the magnetic core type have been commercially available in the U.S. for three years and were being built in national laboratories before that. The first U.K. model is not yet in production and is likely another year away. This is a device which is basic to most of nuclear physics research today. Such devices have also been available from France and Russia for some time.

In view of these deficiencies it seems important that an attempt be made to reorganize the electronics effort. It might first be worthwhile to carefully assess the electronics needs of the Establishment, machine by machine and project by project and then consider how the Electronics Division and the electronics industry can satisfy these needs on time. In the same way any new machine or project proposed must be so assessed at the beginning. Arrangements must be made so that the research side of Electronics Division at present tied up with design of routine devices such as scalers and amplifiers should be freed to develop the new concepts of devices which can never be purchased outside. The latter will be needed in five years time and nothing is being done now. Finally the Electronics Division servicing department must be reconsidered so that they can service any devices which can be bought outside. At present this is very rarely done and so buying outside is severely limited. Perhaps this is best done by decentralizing the servicing so that service shops are attached to each division, project or group like machine shops are.

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