

SCIENCE RESEARCH COUNCIL  
RESEARCH REACTOR COMMITTEE

Neutron Beam Facilities for Universities

Extended Use of Existing Reactors

1. The Committee will recall that at its last meeting it endorsed the recommendations of the Mitchell Panel which had been set up to consider the universities' future needs for neutron beam facilities. The chief recommendation of the Panel was that the S.R.C. should arrange with A.E.A. for substantially greater neutron beam facilities for universities on the A.E.A.'s reactors at both Harwell and Aldermaston, at a cost of the order of £290,000 a year. The purpose of this note is to give an account to the Committee of subsequent events and in particular the decisions taken when the proposals were discussed at a special meeting of the University Science and Technology Board of S.R.C. held on 18th April, 1966.
2. The Board had a preliminary discussion of these proposals on 3rd December 1965, and had asked the Chemistry, Physics and Metallurgy and Materials Committees, which represented the main users, for their comments. There had subsequently been discussions between officials of S.R.C. and the Atomic Energy Authority about the financial and other arrangements which would be necessary if the Panel's report were to be implemented.
3. The main points which had been brought out in earlier discussions and which the Board wished to clarify at their meeting on 18th April were whether the scientific value of neutron beam techniques was sufficiently established and whether there was sufficient interest in, and knowledge of, the techniques among university scientists to justify the heavy expenditure, whether it was necessary at all to pay the A.E.A. a capital charge for a facility which already existed and was not being used to capacity, and whether the charge would be fixed irrespective of the degree of utilisation.
4. The Board had the opportunity of discussing the proposals with Professor Mitchell and Dr. B.E.F. Fender, Oxford University, who represented the users, and Mr. J.J. McEnhill, A.W.R.E., and Dr. W. Marshall, Deputy Director, A.E.R.E. who described the facilities being offered and the method of charging for them.
5. A.W.R.E. are willing to continue to provide the facilities at present being used by universities, at a cost of about £100 K. These amount to approximately one-quarter of the use of the "Herald" reactor. A.W.R.E. is also prepared to provide further facilities up to the scale recommended by the Mitchell Panel, which would be approximately one-third of the capacity of "Herald". The cost for this would be of the order of £140 K. (Details of the calculation of these charges have not been discussed between S.R.C. and A.E.A., but it is based on Treasury rules for the calculation of such charges). A.W.R.E. could provide slightly more extensive facilities if required, or would be prepared to provide something between the present and the proposed level at an intermediate cost. They could not, however, offer facilities less than those at present being used.

An agreement would need to be made for a period of at least three years for the provision of facilities at the level chosen. Arrangements would also need to be made for staff, ancillary equipment, etc., to ensure the safe and efficient use of the facilities. In addition it may be expected that universities would require support by grants from S.R.C. for their university-based work.

6. Similar discussions between S.R.C. and A.E.R.E. on access to reactors and nuclear physics machines providing variable facilities have led to a calculation of a cost of £150 K a year for two years, possibly increasing to £165 K a year for the third and fourth years. This would provide guaranteed access to approximately:

- 1½ single crystal diffractometer
- 1 powder diffractometer
- 1 inelastic instrument
- ½ long wavelength instrument.

It would not be possible to guarantee the provision of small facilities for short periods, and the cost of doing so would in proportion be very much higher even if it were possible.

7. After a full discussion the Board agreed that the opportunity it had afforded for an exposition of the potential value of thermal neutron techniques for the study of condensed matter was most valuable, and they were no longer in doubt that the techniques were highly advanced and that impressive results could be expected from their wider use. Doubts had been greatest among the chemists, but from the discussions it had become clear that when the value of the techniques became better recognised there would be no shortage of demand from chemists for the use of the facilities.

8. The Board were assured that the proposed method of assessing annual rentals for access to the facilities complied with Treasury rules, and that in the opinion of S.R.C. officials the charges were fair and reasonable.

#### High Flux Beam Reactor

9. Higher fluxes than those from the present reactors would be required in a few years, and the A.E.A. proposed to build a High Flux Beam Reactor with a flux of  $10^{15}$  n/sq.cm/sec. The Reactor would be available to universities and also to international teams (mainly from Europe). The S.R.C. would be represented on the Management Committee. The proposed financial arrangements were that the A.E.A. would meet the capital cost (about £7.75 M), and the operating costs would be shared according to a formula relating to the expected usage. The estimated operating costs are £4.790 M per annum of which £1.226 M would be for general irradiation use which would not be available to universities. Of the remaining £3.564 M the universities' share, to be met by the SRC, would be £0.75 M. European interests would account for a similar amount, and the A.E.A. would meet the rest. The SRC would be asked to guarantee to carry their share of the running costs for at least 10 years or to pay a proportion of the unexpired capital value at the time of withdrawal. Charges would fall due about 1971-72. Grants to university teams for additional equipment or staff to make use of the facilities might bring the cost to SRC of research using neutron

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beams to about £1.0 M a year. It was expected that the cost of using the present medium flux reactors would decline when the new high flux reactor comes into use.

10. The Board saw the proposals as a logical development of the present arrangements for university access to A.E.A. reactors, and they welcomed the opportunity of being associated from the outset with the joint project. They had already agreed, in discussing the short-term arrangements for using the present A.E.A. reactors, that neutron beam techniques could be of immense value in the study of the solid and liquid state, and they would wish to encourage the development of these techniques and their extension to higher fluxes. There were already a number of comparable reactors being contemplated, or in the course of construction in America, Russia and France. The A.E.A.'s proposals would be an advance on any known projects, but any major delay in negotiations or construction might cut back the lead. There was, however, a vast potential use for reactors of this type and there was no danger of the subject being worked out before this country could enter the field.

11. The Board believed that there would be virtually no prospect of the universities having access to high flux reactors except by collaboration with the A.E.A. The A.E.A. also believed that co-operation with European interests was also important to reduce the cost of the project, but given that co-operation the cost of the universities' participation became attractive. The Board accepted that the cost of the project should be assessed primarily in terms of its scientific value although it could be confidently predicted that the vigorous application of neutron beam techniques to the study of the fundamental properties of materials could be of potential technological value.

12. After full discussion the Board were in agreement that they could approve in principle the inclusion of provision in their long-term plans for collaboration in the A.E.A. proposals for providing high flux neutron beams. The priority which the Board would be prepared to give to the project would depend on the funds likely to be available in the next five years and beyond, and would also depend on the plans of the A.E.A. for phasing the project. The timing of the project was fairly critical since the reactor would take a long time to build, and this country could not afford a long delay if the project was to remain competitive with similar projects abroad. The Board considered it important therefore that even although a final decision could not be taken at this stage the S.R.C. should give the A.E.A. strong encouragement to go forward with their proposals for a High Flux Beam Reactor.

#### Recommendations

13. The Board felt very strongly that in view of the very great scientific value of neutron beam techniques, provision should be made for the universities to have greater access to high flux reactors than was possible at present. They therefore welcomed both the short-term proposals by the A.E.A. for extending the availability of the present reactors at Harwell and Aldermaston, and the longer-term proposals for building a high flux beam reactor taking the

universities interest into account from the start. The Board would be prepared to find the funds for the short-term proposals within the funds likely to be available to it, but for the more expensive longer-term proposals it would wish to have clearer indications of its future financial position before it could make a final decision.

The Board therefore recommended that:

- (a) negotiations should be started with the A.E.A. for increasing the universities' access to the "Herald", "Pluto" and "Dido" reactors at an annual rental to S.R.C. rising to about £300,000 during the next three or four years; and
- (b) assurance should be given to the A.E.A. that the Council support the A.E.A.'s proposal to build a High Flux Beam Reactor, and are in principle willing to share the cost of its use up to an estimated contribution of £750,000, subject to funds being available.

These recommendations were subsequently endorsed by Council.

#### Users Panel

14. Subject only to receiving the approval of the Department of Education and Science to the proposed arrangements covering extended university use of the existing reactors, it is anticipated that the formal agreement with the A.E.A. (probably separate agreements with A.E.R.E. and A.W.R.E.) will be finalised in time for the start of the new academic year in October. It will then be necessary to set up a Joint SRC/AEA Users Panel, on the pattern suggested by the Mitchell Panel, to control the utilisation of the facilities. The probable composition and terms of reference of the Panel have been tentatively discussed with A.E.A. officials and the following suggestions made:

- who?
- (a) The composition to be made up as follows:

University representatives	(4)
A.W.R.E.	" (1)
A.E.R.E.	" (2)
S.R.C.	" (2)

Mitchell  
Anderson  
Cochran  
~~Conroy~~

Squires

The Chairman to be chosen from one of the four university representatives.

- (b) The main purpose of the Panel would be to consider university applications for the use of neutron beams, and to schedule them according to merit. (It was agreed that the competition for facilities would automatically rule out weak proposals).
- (c) It would also recommend proposals for new equipment at Harwell and Aldermaston which would be desirable within the funds and engineering effort available, and report periodically to the S.R.C. and the Directors of the two establishments, on the facilities provided and the use made of them.

- (d) The existing Sub-Committee on "Herald" facilities would be superceded by the new Panel. It follows that the utilisation of the in-pile irradiation facilities on "Herald" would also come within the province of the Panel.
- (e) Regarding the financial powers of the Panel over the additional calls which would be made on S.R.C. funds for reactor use, it was proposed that for minor financial matters (travel, subsistence and other small items) it would, in effect, have powers delegated to it by the U.S.T.B. in the sense that if an application were accepted for use of the neutron beams then automatically the S.R.C. would meet the minor financial expenses involved. However, any major item of finance, e.g. employing a Research Assistant for a year, making an expensive sample etc., should be referred to the appropriate S.R.C. sub-committee. Approval for additional instruments, support staff and services for "Herald" would also have to be sought separately from S.R.C.
- (f) Applications to S.R.C. for grants in support of neutron beam research on the low-power university reactors could also be referred to the Panel for a technical assessment of merit and suitability of reactor facilities proposed.

The Committee are invited to consider these proposed arrangements and advise S.R.C. as to whether they adequately meet the needs of S.R.C. and the universities to ensure optimum and fair utilisation of the facilities to be provided.

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