

NIMROD PROJECT COMMITTEE

Minutes of the nineteenth meeting held in the Conference Room, Rutherford Laboratory, Harwell, on Friday, 8th April 1960.

Present:- Dr. F.A. Vick - Chairman

Mr. A.L. Ashley	)	Committee Members
- Mr. P. Bowles		
- Mr. L.B. Mullett		
Mr. M.J. Moore		
- Dr. T.G. Pickavance		
Mr. R.F. Payne		
Mr. M. Smith		
Prof. D.H. Wilkinson		
- Dr. J.A.V. Willis	)	Co-opted Members

Mr. A. Miller
Mr. H.J. Harebinks
Mr. H. Hadley

- Mr. S.H. Cross	)
- Mr. G.W. Dixon	
Mr. P.D. Dunn	
Dr. L.C.W. Hobbs	
Mr. J.J. Hughes	
Mr. J.A. Nott	
Mr. G.E. Simmonds	
Mr. G.T. Sneddon	
Mr. M. Snowden	
Mr. G.N. Venn	
Mr. J.J. Wilkins	
Col. N. Wilson	

Mr. F.M. Telling - Secretary

In the unavoidable absence of Mr. D.W. Fry the chair was taken by Dr. F.A. Vick.

The Chairman paid tribute to the memory of Professor Skinner who had been a University representative of this Committee. It was agreed that another University member should be invited to join the Project Committee and an approach would be made in this respect to Professor Cassels of Liverpool University.

1. Minutes of the previous meeting

Apart from a typographical error on page 6 (i.e. harmonies should read harmonics) the minutes of the eighteenth meeting held on 22nd December 1959, were accepted without amendment.

2. Matters arising

Site Labour (PSPC/M18 Item 3). Mr. Ashley reported that the civil contractor was still experiencing difficulty in recruiting skilled labour. The agreed working of overtime had helped, but the labour strength was still below the requirements necessary to maintain programme dates. The problem was not an easy one to resolve since there is a general shortage of skilled labour in this district. A strike over lines of demarcation had meant the withdrawal of labour from the site electrical Contractors. This was not at present a serious problem, but it could have an adverse affect on the programme if negotiations became protracted and labour was withheld for several weeks.

Mr. Bowles said that he had reviewed the site labour situation with Mr. Ashley, and all that could be done was to endeavour to maintain the present labour force by the use of reasonable incentives. For this reason it was recommended that extended working hours should continue throughout the summer months at an estimated cost of £5000. The approval of the Committee was given for this sum to be taken from the acceleration of works sub-head, which contained £56,600 of the original £100,000.

3. Progress of Building Work

Mr. Ashley reported that building work in the Magnet Room and the Experimental Area was virtually completed. The completion of various external works to the main building as being hastened to allow the earth mounding to be progressively maintained with final completion by early July, 1960. Work on the Converter House

was continuing and should be ready for plant access by the end of April, 1960. The Alternator House was slightly behind programme apart from the alternator foundation block which presented a difficult construction problem and would not be completed before October 1960. A set-back had occurred on the construction of the Hydrogen Bubble chamber and Plant Room buildings due to delay in the supply of various items from nominated sub-contractors. Mr. Ashley added that every possible effort was being made to expedite the supply of these items and pressure was being put on the Consultants who were responsible for progressing these materials to site. Nevertheless it was doubtful if the building work would be completed before the end of June 1960.

Mr. Moore remarked that this delay in the building work would seriously affect the entire Bubble Chamber programme. Mr. Mullett asked if a revised programme had been issued for this work. Mr. Nott said that such a programme had recently been issued and copies would be sent to all concerned.

The Chairman asked if it was possible to expedite construction work on the Bubble Chamber Buildings. Mr. Ashley replied that apart from the delay in progressing materials to site the general labour shortage was also a problem. Effort was being put on to these buildings at the expense of other site work and this effort would be maintained until the Bubble Chamber building work was completed.

The Chairman asked what progress had been made on the construction of the alternator foundation block. Mr. Ashley replied that the design details had only recently been agreed and it was proposed to hold an early meeting with the English Electric Co. to discuss the method of construction.

Mr. Moore enquired why there had been such a long delay in establishing the design of this foundation. Mr. Bowles replied that there was no precedent for the large suspended foundation now designed. In the early design the English Electric Co. were asked to give a guarantee that the bond between the reinforcing steel and the concrete would remain sound under the pulsing load conditions of the rotary plant. Since no such guarantee was forthcoming the Project Group had no alternative but to examine in greater detail the whole basis of design and construction. As a result, post tensioning of the concrete block was incorporated and this allowed the design to be much less dependent upon the bonding of steel to concrete than it was in the original design. About this time a crack had been reported in the foundation of the C.E.R.N. rotary plant and a complete re-check of the English Electric design revealed that the value of Young's modulus for concrete had been taken for static rather than dynamic conditions. This wrong assumption made the resonant frequency of the foundation block approach the frequency of the disturbing forces produced at the rotational frequency of the machine. At this stage the Project Group sought specialist civil engineering advice from within the Authority and had gone through the whole basis of design calculations and construction techniques, and were now satisfied with the design. Although this had meant some delay, the original programme was replanned to allow the alternator building fabric to be erected ahead of the foundation block and although this had made the construction of the foundation block more difficult it had prevented an undue delay on the overall building work.

Mr. Ashley concluded his progress report by adding that although the construction of the alternator foundation block presented a difficult construction programme the time scale should not seriously delay the alternator commissioning phase. The main site drainage scheme was progressing well and should be completed by the end of June 1960. The construction of the cooling towers and plant room was proceeding to programme. With regard to M. & E. labour Mr. Ashley pointed out that recruitment difficulties indicated that a shortage of staff could occur by the end of 1960.

4. Reassessment of the Construction Programme

The Committee had before them a paper (PSPC/P63) giving a reassessment of the construction programme.

In introducing the paper Mr. Bowles said that in previous papers to the project Committee the difficulties of maintaining the terminal date of December 1961 for the completion of the machine construction were enumerated. Of the

major components the magnet sectors would be delivered to schedule, and the magnet coils and power supply plant were generally to programme. The supply of the main vacuum chambers and the magnet pole pieces were behind programme and the manufacturing processes could not be fully assessed until prototypes had been made. Quite recently the supply of stainless steel had become protracted and this would in due course affect the delivery of several components. Alternative supplies from British and Continental Sources had been sought, but without success. Difficulties had also been experienced in the manufacture of the R.F. liner for the Injector and since access for this liner was via the magnet room any further delay in delivery would prevent the setting up of the magnet sectors on the sole plates and also interact on the earth mounding programme. The position might dictate taking the liner in an unfinished state and completing ~~on~~ site. These set-backs suggested that the machine might not be completed to the original programme date and it was therefore requested that the Project Committee take note of the proposed revision of the programme giving a completion dated of mid-1962, and that the formal issue of the master programme be delayed until June 1960 pending the completion of the first section of the vacuum chamber, and prototype pole pieces.

Mr. Moore asked whether it would be possible to relax on the stainless steel requirements. Dr. Pickavance replied that materials for certain components were being looked at with a view to substituting other materials if at all possible. It might also be possible to replan the sequence of erection of the stainless steel items to give the least possible delay to the overall programme.

Mr. Hughes remarked that early deliveries were promised from certain sources but only at a greatly increased price which the Group did not consider justified in paying.

The Chairman enquired about the progress of the main vacuum chambers. Mr. Bowles said that the development work and the production techniques in a basically new engineering material was proceeding at Marston Excelsiors. The completion of the first section was expected during June 1960 and this might have to be regarded as a prototype. Mr. Cross added that a lot of work had been necessary in establishing the resin process and fabrication techniques but the problems were being satisfactorily resolved.

Mr. Moore asked whether we could accept this position, and suggested that further pressure should be put on Marston Excelsior to make certain that they maintained the June date. Mr. Mullett pointed out that during the development stage a good deal of uncertainty had existed about the resin process and curing cycle for the epoxy resin laminates, and subject to this limiting factor we believed that all possible pressure had been applied to Marstons, now that these uncertainties are rapidly being resolved further action may be possible. Mr. Simmonds said that the Group had helped in procuring production tools for Marston Excelsior. The June date was a firm one, the only difficulty being whether the large section could be produced to the required dimensional accuracy. Once this was established the production rate could be geared to the curing cycle time.

Prof. Wilkinson enquired if production time could be reduced by the use of multiple tooling. Mr. Mullett pointed out that the cost of tooling was already a very large fraction of the total cost.

The Chairman asked for every endeavour to be made to achieve the completion of the first section by June 1960, since this would enable a realistic programme to be established for the delivery of the remaining sections.

With regard to the progress of the magnet pole pieces Mr. Wilkins said that it was known that modifications to the profile would be necessary, and until the Group received a prototype it would not be possible to assess the production techniques. Mr. Moore thought it a serious matter that the English Electric Co. had not yet managed to stick a pole piece together. Mr. Wilkins replied that laminations had been stuck together and during the next few days a complete block was expected. A prototype pole piece to the required profile was expected by mid-May 1960.

Mr. Bowles said that a letter had been sent to the Managing Director of the English Electric Co. stressing the urgency of the development stage of this contract and recent events had shown that this was having the desired effect.

The Chairman asked to be kept informed of any delays which might tend to retard the pole-piece programme.

Prof. Wilkinson said that the end of 1962 had been given as a date for the availability of the machine to the users, and slipping the construction date a few months did not matter providing the users' date could be maintained. Dr. Pickavance said that by June 1960 prototypes should be available for the vacuum chamber and the pole pieces. This would enable the programme to be defined and recast in detail. If it were possible to advance the completion of the machine construction then every effort would be made to do so.

The Chairman asked the Committee to take note of the proposal to revise the machine construction programme and the need to re-examine the proposals in June 1960 when prototypes of major components should be available. This was agreed.

5. Building Estimates

The Committee had before them a paper on the NIMROD revised building estimates (Paper PSPC/P61).

The Chairman said that this paper was prepared since the last meeting of the Project Committee and had been submitted to the February meeting of the General Purposes Committee.

Dr. Pickavance reported that the paper showing the revised building estimate, including a contingency figure within which Phase I work would be completed was accepted by the General Purposes Committee. Treasury approval however had not yet been obtained since the revised plant estimate was awaited to enable Treasury consideration to be given for a grant to complete the whole of the NIMROD project.

The Committee took due note of paper PSPC/P61.

6. Machine Estimates

The Committee had before them for discussion a paper (PSPC/P60) showing the revised machine estimates for NIMROD.

Mr. Bowles introduced the paper and said that it was necessary to present it in considerable detail because the estimated cost of the machine to meet the original specification shows an increase of about £1.18M over the present estimates approved by the Treasury. The Review had been difficult since even now there were design uncertainties in some areas. Where this was so a high contingency allowance had been shown, and a figure representing the best consensus of opinion included in the estimate. In compiling the estimate it was appropriate to mention that: there had been negligible expenditure on items which are additional to the original specification; 95% of the expenditure on contracts placed was as a result of competitive tendering; increases in labour rates and material costs had given rise to progressive increase in the cost of contracts placed. Increases had been apparent as the detailed design evolved, the major increases being associated with the Injector, Magnet and Vacuum System. The reasons for these increases are detailed in the appendices to the paper.

Mr. Moore enquired why such a high contingency allowance was necessary on the main pole pieces when a manufacturing contract had already been placed.

Dr. Pickavance replied that the contract for manufacturing the pole pieces was placed with the English Electric Co. on an agreed provisional specification. It was not possible to determine the final specification until prototypes had been received and tested. The testing of these prototypes would undoubtedly lead to modifications to the profile and this in turn would add to the final cost of the production pole pieces. The revised estimate took into account possible modifications, but since the Treasury had asked for a contingency figure within which the machine would be completed, and since this particular component represented an area of uncertainty, then any contingency figure included must be an adequate one. Mr. Venn pointed out that the contingency allowance was usually expressed as a percentage and since the design details had not been settled the contingency for the pole pieces was high, i.e. 25%.

With regard to the estimate for the R.F. system Mr. Dunn said that tendering action had been taken for the drive chain unit. Out of six firms invited to tender, five declined and the remaining tenderer wanted to provide this unit on a development contract which would undoubtedly increase the estimate. The prototype had been made by the Group, and it was now a question of providing a drive chain for the main machine to good engineering standards. The present estimate appeared inadequate.

The Chairman asked for the estimate for the drive chain to be increased to £15,000 with a contingency allowance of £3750. This was agreed.

Mr. Simmonds pointed out that the present contract with Marston Excelsior would need to be revised to £398,000. This was the estimated cost of the development work, provision of production tools and the manufacture of the prototype octant. The price to be paid for the production of the further eight octants required an early discussion. It was originally intended that fixed price should be negotiated simultaneous for the three sections of a complete chamber. The procedure should now be progressive, starting with the outer chamber.

The Chairman asked the Committee's approval for increasing the present Action contract with Marston Excelsior, and for a paper to this effect to be submitted Mr. Bowles to the next meeting of the General Purposes Committee. This was agreed.

Mr. Smith thought that the reference to the percentage increase in labour costs should be omitted since this was a point which might well bring forth criticism at Treasury level. This was agreed and the Chairman asked for this particular paragraph to be redrafted.

Mr. Bowles asked the Committee particularly to note that with a project of this magnitude and complexity additional items could still arise which might prove essential for the proper functioning of the machine. No allowance for such items had been made in the revised estimates and the contingency sum could be inadequate to cover such items.

Dr. Willis said that the increases in estimates had been discussed in general terms with the A.B.A. Finance Branch and since Treasury approval of the revised building estimate was withheld pending the submission of the plant estimate, it had been agreed to ask for an interim increase of £150,000 by April 22nd 1960 to avoid overcommitting the building estimate.

The Committee took note of Paper PSFC/P60. Certain corrections and additions were noted and the Committee then endorsed the submission of this paper to the next meeting of the General Purposes Committee.

7. Ripple Filter Equipment

The Committee had before them for discussion a paper PSFC/P64 outlining the methods and equipment proposed for reducing the effects of ripple voltages on the NIMROD power supply.

Mr. Wilkins introduced the paper and said that although careful circuit design had reduced the ripple to an unusually low order, at certain frequencies there could be significant ripple which could cause a reduction in proton beam intensity, and could limit the potential usefulness of NIMROD. The proposed equipment provided means of overcoming this ripple effect, the methods employed being detailed in the paper. The estimated cost of this scheme was £90,000 which was £10,000 above the notional sum included in the approved estimates. It was recommended that the scheme for reducing the effects of ripple voltages be adopted.

Dr. Pickavance said that if tenders for the supply of this equipment showed that the cost was in excess of the estimates then the Project Group would reconsider the design proposed.

The Chairman asked the Project Committee for approval in principle at the cost given and for a paper to be circulated at a later date when approval for

placing a contract was required. This was agreed.

8. Date of Next Meeting

The next meeting will be held at the Rutherford Laboratory on Wednesday 20th July 1960, commencing at 2.15 p.m. in the Conference Room of the main office block.

F.M. Telling.

Rutherford Laboratory,
Harwell.

May 1960.

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