

BRITISH NATIONAL HYDROGEN BUBBLE CHAMBER WORKING PARTY
MINUTES OF MEETING HELD AT BIRMINGHAM UNIVERSITY ON FRIDAY 2nd MAY

Present

A.E.R.E.	Dr. E. Taylor Mr. M. C. Snowden,
Birmingham	Professor P. B. Moon Mr. D. C. Colley, Dr. L. Riddiford
Imperial College	Professor C. C. Butler, (Chairman) Mr. N. C. Barford, Dr. W. Welford
Liverpool	Professor H. W. B. Skinner Dr. W. H. Evans Mr. M. J. Moore Mr. P. R. Williams (Secretary)
Oxford	Dr. D. Shaw

1. Minutes of Previous meeting

The minutes of the meeting held on 26th. March at Imperial College were approved

Butler reported on the meeting of the steering committee held on the afternoon of 26th March at Imperial College. The estimates had been passed by the D.S.I.R. Nuclear Physics and Research Grants Committees and he hoped that a final decision would be made on 8th. May. It was anticipated that this would enable some orders to be placed by September.

2. Report from Birmingham Group

- 2.1. Riddiford reported that an estimate for the cost of constructing the magnet had been received from Metropolitan-Vickers. The Figure given was £90,000, this to include mounting framework and trolley plus delivery to a site in England. He pointed out that this was to be compared with the figure of £64,000 quoted by both G. E. C. and Brush, which included mounting in the case of Brush, but not G. E. C.
- 2.2 In addition to the magnet cost estimate, Metropolitan-Vickers had submitted an estimate of £34,000 for the cost of a 3 M watt Mercury arc Rectifier Set, to be compared with the Brush Estimate of £36,000 for a machine of similar power.
- 2.3 Riddiford raised the question of the ripple which could be tolerated in the D.C. supply. It was possible to reduce the ripple in the current supplied to the magnet to 0.1%, but if this appeared as a 0.1% ripple in the field at 1000 c/s preliminary calculations showed that large power would be induced in the chamber. Riddiford agreed to look into this aspect of the magnet design in more detail.
- 2.4 The field uniformity in the 1/12 scale model magnet had been checked and the maximum non-uniformity found to be $\pm 6\%$. In reply to a question by Snowden, Colley stated that the field tests on the model had been carried out at a field of a few 100 gauss.
- 2.5 The expected delivery time for the magnet was 18 months from signing the contract.
- 2.6 Skinner urged that a proper specification be drawn up as quickly as possible, and that this should be sent to a large number of firms in order to get competitive tenders. The design and specification should be out to tender on 1st. October.
- 2.7 The meeting agreed to accept the field uniformity figure of $\pm 6\%$ and were satisfied with the distribution of copper and steel in the magnet.
- 2.8 The meeting decided not to go ahead with the scheme for building a pulsed model magnet working at high power.

- 2.9 In answer to a question by Barford, Riddiford said that the cooling water temperature rise in the magnet would be less than initially stated. C.E.R.N. would be expected to supply the cooling water services.

3. Report from Imperial College Group

- 3.1. Barford showed a schematic design for a window test chamber which would allow several operations on the windows to be carried out.

- (a) Window coating
- (b) Low temperature Testing
- (c) Rate of cool down tests
- (d) Gasket and flange tests

The meeting decided that a vessel of the ^{type} ~~line~~ described should be obtained.

- 3.2 Welford reported that as a result of a telephone conversation with Williams, he had recalculated the sizes of the lenses and for the proposed optical scheme, the lenses had a height of 59 cms. He had an alternative scheme in which one component of each of the three sets was positioned very near to the chamber window. In this case, no lens was required to have a height in excess of 53 cms. The alternative scheme had the slight disadvantage that for one camera there would always be two 1 cm. wide shadow regions on the pictures.

It was agreed that the Liverpool group should recommend which system should be adopted.

4. Report from the Liverpool Group

- 4.1 Williams reported that two cost estimates had been received for construction of the vacuum tank.

Metropolitan-Vickers	£30,000
John Thompson	£19,000

The Metropolitan-Vickers estimate includes X-ray examination of the welds and vacuum testing. The John Thompson figure would not include any testing or weld checking. It was hoped that further estimates would come in the very near future.

- 4.2 James Booth had withdrawn from the project of producing the large light alloy forging. A quotation had been received from Messrs. High Duty Alloys. This was £9,000 for production of the rough machined forging with a delivery date of 3½ to 4 months from placing the order.

- 4.3 Barford asked a question about the size of the chamber and glasses.

It was decided that the glasses should present an aperture of 150 cms x 50 cms. with semi-circular ends, and that the distance between the inside faces of the glasses should be 38 cms. The size of the glasses was agreed to be 165 cms x 65 cms. with semi-circular ends.

5 Liquid Hydrogen Safety Shield

- 5.1. Liverpool presented a preliminary design of a Liquid Hydrogen safety shield. Discussion followed in which it was pointed out that with the proposed optical system it was not possible to design a shield capable of standing a differential pressure of 3 atmos. with small glass windows. Shaw pointed out that the temperature of the windows in the shield would be considerably in excess of 27°K. It was felt that such a shield would not be an appreciable addition to the safety of the instrument due to the problem of sudden thermal shocks causing failures in the shield windows. The meeting decided not to include a liquid Hydrogen shield in the design.
- 5.2 Barford asked whether it was though advisable to include a liquid hydrogen radiation shield. The Liverpool group agreed to look into this question again. Butler pointed out that a decision had already been made not to have such a shield.

- 5.3 Skinner pointed out that the important point was to make sure that the vacuum tank was 100% safe. To ensure this it was agreed that light sources and cameras must be enclosed in pressure tight boxes to be an added safety measure in the event of a vacuum tank window fracturing..

The vacuum tank should be connected via rupture discs and two large diameter tubes to a hydrogen dumping vessel.

6 Testing Facilities

- 6.1. The chamber should be tested in the U.K. without its magnet. Skinner stated that during the testing period a staff of not less than 18 Physicists and technicians would be needed. This meant that about 8 houses in addition to some hostel accommodation would have to be provided at the test site. He said that as a result of a talk with Pickavance he had the opinion that such accommodation would be difficult to find at Harwell. Snowden said that given 18 months notice Harwell would add the necessary houses to its building list, but there would still be a three month waiting time between starting work at Harwell and getting a house. Skinner said that in his opinion this was an unacceptable arrangement, a sentiment with which the meeting agreed.
- 6.2 Skinner asked why the test site should be at Harwell. Butler replied by saying that as this was the final home of the chamber it would be a good idea to build up the test facilities at the National Institute. He stated that if there were delays due to treasury and staffing difficulties the National Institute accelerator may be ready before the chamber had gone to C.E.R.N. in which case it was doubtful if the chamber would ever leave the National Institute site.

Skinner stated that since much of the responsibility for testing would be carried by members of the Liverpool group, he thought that a Liverpool test site was a realistic alternative to the National Institute.

No decision was taken on the test site.

- 6.3 Testing in Geneva. Skinner proposed that a test building should be erected by C.E.R.N. in a position to the South of the main Experimental hall by the access road. The chamber should be capable of being wheeled from the test house into the experimental hall in a fully assembled condition. //

7 Any other Business

The question of liquid hydrogen supplies was raised. Butler reminded the meeting of the C.E.R.N. and Berkely points of view that a liquefier should be provided for the chamber and permanently connected to it. Shaw said that the Oxford view was that storage and transfer of liquid hydrogen from a remote liquefier was safer than the production in-situ. Riddiford pointed out that the provision of the chamber liquefier was a sounder economic and more efficient project. Shaw volunteered a report on this question to be presented at a future meeting.

Moore stated that in his opinion the question of the liquefier should not be allowed to hold the project up and urged for a firm decision. Butler said that the liquefier question did not affect any other part of the design since all that required of the chamber design was a convenient point for connecting a transfer line.

The next meeting was fixed for Friday 30th May at Liverpool to commence at 11.00 a.m.

Bubbles Spaniel.

Bubble Chamber - Auxiliary Equipment

(Telephone conversation with Dr. Pickavance)

- 1) 4 M.W. D.C. Generator *Cabling ?* £60,000
 - 2) Hydrogen Compressor. 200 cfm - 2,400 p.s.i. - 125 H.P.
B.O.C. spot quote £18,000.
Cost with various additional items ~~B.O.C. Premium etc.~~ £25,000
 - 3) Hydrogen Storage Gasometer 400 CF capacity
(We paid £330 for 150 CF. tank.) 2,000
 - 4) Hydrogen Dump tank 6,000 CF capacity, 150 p.s.i.
and vacuum. Sphere 23'-0" dia.
Berkeley say 75,000 dollars £25,000
 - 5) Vacuum Pumps for Dump Tank. 500
 - 6) Hydrogen High Pressure Storage System. 30,000¹⁶⁰ CF.
capacity - 2,400 p.s.i. Berkeley use 10-12 large cylinders. For a 7,500 CF system we use 30 x 240 CF - 1,800 p.s.i. and these cost £20 each. This installation with trailer could cost about 12 - 15,000. 15,000 *R.A.F.*
 - 7) Hydrogen Purifiers and Driers. (This might well be our problem on the Bubble Chamber)
Pipelines etc. *D2Ox. - Baker Platinum Ltd.* 15,000
 - 8) Fork lift truck (Window moving) *52 High Holborn W.C.I.* 2,000
-
- £144,500
-
- 9) Liquid N₂ storage Vessel - *B.O.C. 18 mels delivery Also available on loan* 5,000

R. Gayler 2006 2408

Hydrogen Plant @ Cambridge

Bittern 20.

356/160
2000 CF.

£220

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