TWENTY-FIRST SESSION OF THE COUNCIL

Geneva - 13 June, 1962

TRAINING AND EDUCATION AT CERN
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1. The Scientific Policy Committee and the Council have shown increasing interest in recent months in CERN's function in education. Article II, 3(c)(ii) of the Convention sets out the following purpose: "The promotion of contacts between, and the interchange of, scientists, the dissemination of information, and the provision of advanced training for research workers."

2. For the Member States, advanced training of research workers may mean rather different things according to conditions in their own universities and research institutes; for CERN itself the provision or encouragement of some sort of training of all grades of staff seems to be a necessity of good management. On the other hand, the adoption of a serious training and education programme will obviously mean eventually a certain burden on man-power, and certain parts of the programme will have to be carefully planned to ensure that the needs and wishes of the Member States are met.

3. An internal working party was therefore set up at the end of last year and reported in January. Their report, together with the preliminary views of the Directorate, was submitted to the Scientific Policy Committee at its Twenty-third meeting in March and the matter subsequently has been extensively discussed again within CERN. The present paper, which takes account of the views expressed at the Scientific Policy Committee, is the result. It describes briefly, against the background of present training and educational activities in CERN, certain measures which it is intended to put into force, at once, so that a provisional programme may be in operation by the autumn. It leaves some questions open, so that, after a preliminary discussion at Council, further work may be done, and more definite proposals put forward for the approval of the Council in December.

4. It might be useful to get out of the way first the sort of specialized and intensely practical training which has always been given at CERN, for instance, to machine and power-house operators, to scanning girls and so on. This of course is compulsory and takes place in CERN time. It may be necessary to develop it here and there, for instance, for workshop foremen, for stand-in and emergency staff for certain functions, and so on, but this type of training raises no difficulties of principle or policy.
The planning of a wider training and education programme for CERN faces a number of serious problems. The primary activity of CERN is research and, therefore, any secondary activity, such as training and education, must not draw too much man-power and resources from the primary activity. On the other hand, it is obvious that a certain amount and a certain kind of training will, in the long run, be beneficial to the quality and quantity of research done at CERN.

Hence the guiding principle in the planning of a training programme must be its usefulness for the research effort rather than its intrinsic educational value for the staff.

The amount of training will be restricted by our limitation on financial and man-power resources.

A training programme should start on a not too ambitious scale for two reasons. One is the critical shortage of experienced man-power at CERN and in Europe. The people who are able to give useful courses are exactly those who are essential for our present research and construction programme, and therefore are under a heavy load already. The hiring of additional staff for that purpose is next to impossible, not only because of budget limitations but also because they cannot be found easily. The second is the fact that a reasonable training and lecture programme must grow: in order to avoid grave mistakes which would jeopardize the whole venture, we must start on a relatively modest scale and re-examine later the possibilities of further expansion.

It also follows from our guiding principle that the topics of the courses should be of a not too general nature. Topics which are taught at most training schools or at most universities should be avoided. The courses should cover subjects of direct importance for the work at CERN. They should enable the participant to learn subjects which are needed at CERN and which are generally not taught elsewhere.

The problem of training and education at CERN falls into two distinct parts. One is the training of technicians (this term is meant in a wide sense and includes operators, artisans, mechanics and junior engineers). The other is the training, on an academic level, for scientists and engineers. Although it is obvious that CERN should encourage its staff to increase the width and depth of their skills, particularly in the specialties appropriate to the work at CERN, very little has been done until now within the above-mentioned first category. More was done in the second category;
a certain number of seminars and courses were given regularly for physicists, mostly by the Theoretical Study Division. They served to introduce our physicists to special problems of elementary particle physics. Rarely, however, did these courses include experimental subjects and almost never any high-energy engineering topics.

7. The training of technicians

For the beginning, that is the coming school year (autumn 1962 to summer 1963), we propose to organize courses for technicians in the wider sense of the word in a number of subjects of interest at CERN such as:

- Transistors and their use
- Vacuum technology
- Special electronics devices
- Use of computers (programming)
- Cryogenics.

There should also be an introductory course for this group of people on the work done at CERN, in elementary and understandable form.

These courses should be accompanied, if possible, by practical exercises in laboratory or workshop. At the end of each course an examination should be given, so that every participant can obtain a certificate proving his mastery of the subject.

In addition to courses of this kind, CERN staff should be encouraged to improve their qualifications through training under outside educational authorities and specialized schools in Geneva.

It may be possible to arrange for special courses, not at present on their programme, at the University or the Ecole des Arts et Métiers at Geneva, and even to arrange for courses to be given in English; these matters have to be explored. Such courses would, of course, normally finish with an examination or a certificate of studies.

These outside courses would tend to be of a rather more general nature, for instance, in General Physics, Mechanical Drawing, General Electronics and so on. Some staff members follow such courses already, and are given reasonable facilities to do so. What is needed now is a more purposive effort to expand this.
8. The Academic training programme

Since there are already a number of courses given on academic level, it is easier to extend this part of the programme. We should aim at a small post-doctoral school in high-energy physics and technology. This would imply an increase of the present number of courses for the next year or two by about 50% and the addition of a number of courses on experimental techniques and on engineering problems. In particular, training is needed in up-to-date mathematical and technological skills which a fully qualified engineer requires for working on the problems encountered at CERN.

Regular seminars should be included in the programme such as the present Tuesday afternoon seminar, devoted to the CERN experimental research, or the Monday seminar of Professor Weisskopf on the theoretical foundation of elementary particle physics.

Courses of general nature, which are not directly connected with CERN research, such as Quantum Mechanics, General Relativity, Theoretical Physics, should be avoided.

For some of the courses it may be appropriate to arrange terminal examinations, or to ask for essays, so as to encourage in particular background reading.

9. The organization of the training courses of both categories would very probably be a full-time task, when account is taken of the very great variety which may eventually develop, and the many dealings which will be necessary with the authorities in Geneva and elsewhere.

We cannot yet, however, see sufficiently clearly exactly the sort of man we should want, and it seems very probable that to recruit him would take a considerable time, while we are anxious, if possible, to get matters moving this year.

We propose, therefore, as a preliminary measure, to appoint one staff member for the organization of the academic training programme and another for the technician training programme. The former task is probably not a too heavy one, and can presumably be done on a half-time basis. The latter task is more difficult. Presumably it will be necessary to spend a few months, practically whole-time, exploring the whole field further, and in detail, so that he may be able to organize a first series of courses, which will bound to be, to a large extent, tentative, to test the demand for such courses and to find out what are the sort of problems which
will have to be dealt with, to conduct the first serious discussion with outside education authorities and find out what can be done on this side. As a result we may hope by the end of the year to be able to report to Council the result of the first short session of the courses and be able to present more precise plans of what we expect to do on this sort of instruction in the future.

10. We expect that the teachers of the courses regard the teaching duty as part of their duty to CERN. The participants of the courses are expected to regard the course work as a serious responsibility. The time of the courses may be partly working time and partly spare time.

11. In the past several graduate staff members and fellows have been able to arrange to do the experimental work and to prepare the thesis for a Doctorate at CERN, the Doctorate of course being granted by their own University. Interest in this possibility seems to be growing in several Member States, and it seems clear that there are experimental facilities here which cannot be provided at many European Universities, and that it may be a real advantage, principally perhaps to the smaller Member States, if arrangements could be made for CERN to accept a certain number of graduates who would take their Doctorate here.

The problem of selection of Ph.D. candidates, their pay and their supervision is not yet solved. Further studies will be necessary. The selection and pay might be done on similar lines to our fellowship programme. The supervision of each student could be the responsibility of a staff member, preferably of the same nationality, who is acquainted with and acceptable to the University which confers the degree.

If this conception meets with the Member States' approval, it would be most useful if they could explore what arrangements could be made by their Universities and in what conditions for the nomination, examination and granting of degrees to such Doctorate candidates. If it were possible to provide some guidance on this subject by the autumn, definite proposals to this end could be put forward and provision made in the 1963 Budget.