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Report of the fourth meeting of the Ad Hoc Group of Scientific Experts to Consider International Cooperative Measures to Detect and to Identify Seismic Events

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INTRODUCTION

The fourth meeting of the Ad Hoc Group of scientific experts to consider international cooperative measures to detect and identify seismic events was held in Geneva from 25 July to 5 August 1977. At this meeting the Group reached a consensus on first drafts of the remaining chapters of the final report. For reference, the provisional table of contents to the final report (Conference Room Paper No. 4) is attached.

A list of the full set of documents considered at this meeting is given in Conference Room Paper No. 30/Rev. 1, attached. Copies of all of these documents are available at the Earth Physics Branch. Copies of each of the draft chapters and a number of other documents that are referenced in this report are attached.

The first week of this meeting was an informal working session used primarily to complete first drafts of material that remained from the April meeting. The first week's meetings were attended by representatives from most of the countries in the Group; the most notable absences were the Federal Republic of Germany, New Zealand and Czechoslovakia. Draft material on which a consensus was reached during the first week was approved more formally during the second week plenary session, usually with little further discussion. The Group was expanded at this meeting by the participation of Dr. L. Ocola of Peru during the second week.

The following is a brief summary of the discussions of the draft chapters in the order of their appearance in the provisional table of contents.

DISCUSSION OF DRAFT CHAPTERS

Chapter 4 - Global Networks

The draft of chapter 4 contributed by Canada (GSE/CAN/1) received very little discussion. During the introductory remarks the point was repeated that it is difficult to write the section on desirable new stations because of the absence of criteria, e.g., a preconceived desirable network capability, on which to base a discussion. A consensus was, however, reached that the report should contain some general comments concerning: a) the desirability of additional stations in the southern hemisphere, and b) the general desirability of more digital stations that can provide event identification data. Appropriate text will be prepared by the Scientific Secretary for either chapter 4 or chapter 8 in the first full draft of the final report.

Chapter 6 - Data Centres

A discussion of data centres occupied much of the first week of the meeting, during which sections 6(b-d) went through four drafts before consensus was reached on the attached draft.

The Soviet delegate repeated his opposition to the phrase "national centres" that had appeared in earlier drafts, and again indicated that only the "States parties to the treaty" would have official contacts with an international centre. The convenor (Thirlaway, U.K.) objected to the latter phrase because its meaning will not be clear until the text of the treaty is available. This was solved to Soviet satisfaction by using the phrase "government-authorised centres under the complete control of the State within which they are located".

On a U.S. suggestion the convenor had written a draft in which a number of options were described for the infrastructure of the data exchange system, from an option "zero" with no international centres and exchange only among national centres, to an option III with a complex structure of national centres, international centres and communications systems. The U.S. had favoured the multi-option approach in the final report in order not to be committed. Strong opinions by, e.g., Sweden and Bulgaria that the Group should be making a firm recommendation to the CCD and the view of the U.S.S.R. that there should be more than one international centre, led to the present draft of chapter 6 which describes the options in more general terms and illustrates the one favoured by the Group.

There were clear statements by a number of delegates that scientifically and technically only one international centre is required, and by the Netherlands delegate that, therefore, the question of more than one such centre would be a political requirement with which the Group should not be concerned. The Soviets countered with analogies; with the WMO Global Telecommunication System which has three principal nodes (Washington, Moscow and Melbourne) and with the three world centres for geophysical data (WDC-A, B and C), which improves efficiency in data storage and access. The final draft of section 6(c) eventually included the wording "In order to achieve a reliability acceptable to all, it is proposed that more than one standardized international centre be established", to which no further objections were made.

The motivation of the Soviet Union in insisting on more than one international centre is not much clearer than it was at the April meeting;

they insist that one of the centres be in the U.S.S.R., so it follows that there should be more than one.

Chapter 7 - Costs

The discussion of the convenor's (Harjes, FRG) draft of chapter 7 did not take place until the end of the second week, and was rather short.

The present draft will require some reorganization and is more relevant to a country that has one central seismological observatory (e.g. FRG) than to a country operating a network of widely spaced stations (e.g. Canada). It is however, essentially a description of hardware requirements with some sample costs and does emphasize the extra staff required to extract data on a routine basis. The latter was of particular concern to Canada, was expressed to the convenor in GSE/CAN/3, and was supported in other statements by the U.S. and Denmark. The statement in the present draft that up to three full-time seismologists will be needed at each station is not consistent with the Canadian view that much of the additional data reduction would be done at the central facility; however the wording can be checked in the first full draft.

The only significant addition suggested for the draft chapter was the cost of computer software (development or purchase) for the international centres.

Chapter 8 - Network Capabilities

The convenor (Filson, U.S.A.) prepared a comprehensive draft of chapter 8 for this meeting, having taken most of the suggestions made at the April meeting and displaying results for each of the three networks described in chapter 4.

In a computational study of this type there is an endless number of variants that can be presented. Although the Group is quite satisfied with the present results in chapter 8 and commended Filson for the large amount of work he has done, suggestions for three more sets of calculations were made at this meeting and will be produced for consideration. The long period detection capabilities will be computed for two-station detection, in addition to the four-station detection in the present draft. The capabilities to measure short period identification parameters using digital stations will be computed with distances restricted to greater than 20°, i.e., in the teleseismic window only. Capabilities will be computed for a fourth, hypothetical, network composed of SRO equivalent stations. That is, the computations will be repeated for Network III (SP and LP) assuming all stations have at least a capability represented by average SRO noise levels.

The suggestion for the latter was made by the Soviet Union in order "to show what network efficiency can be achieved in the most favourable conditions" and "so that part of the report would retain significance for a number of years". It is evident from this suggestion and from other comments made in discussion, e.g., that lower signal-to-noise ratios should be used in some of the other network calculations, that the Soviets would like to have in the final report as optimistic a picture as possible of the network capabilities. One can only assume that they believe this would provide some support of their position that national technical means supplemented by international data exchange would be adequate for verification. This type of hypothetical network calculation has been done a number of times in the past and does not present particular difficulties for us. It will however be important to

ensure that the final report contains the appropriate qualifications with respect to the validity of such calculations.

As is apparent from the attached draft of chapter 8 and the above additions, this material will be rather long and detailed in the final report. In the first full draft, chapter 8 will likely be reduced to a brief non-technical summary of the results with the detailed material relegated to an appendix.

Chapter 9 - Experimental Exercises

Suyehiro (Japan), convenor of this chapter, had received a large number of conflicting contributions on the subject of experimental exercises and was unable to consolidate the views into a draft prior to the meeting. Illustrative of the range of views are the following. Norway suggested that an executive group of the Group start immediately to plan and implement an experimental exercise and aim for obtaining concrete results before the end of 1978. The Soviet Union (in GSE/U.S.S.R./2, attached) suggested that an experiment with 45-50 stations in the global network, and three international data centres in Washington, Moscow and Melbourne, be carried out "after entry into force of a treaty on the complete and general prohibition of nuclear weapon tests".

In order to avoid a very long formal discussion of this topic, Suyehiro arranged a private meeting with Filson and Turnbull (U.S.), and Dahlman (Sweden), Thirlaway (U.K.) and Basham (Canada) to devise a plan for discussion in the full Group meeting. The result of this meeting was a Suyehiro memorandum to the Group (attached). A Canadian statement supporting the memorandum was supported by the U.S.S.R., U.S. and Sweden, but opposed by Denmark and Norway who wanted a more detailed description

of an experimental exercise in the final report.

The resulting draft of chapter 9 (attached) contained much of the content of the Canadian working paper (GSE/CAN/2), but did not over-emphasize the concept of preparation for full scale operation of a global system. This concept was identified, in private discussions, with the Soviet position that an "exercise" and/or "full scale operation" would commence after entry into force of a full treaty; it was the purpose of the Canadian paper to emphasize the implications of a full scale experiment and the preparation that would be necessary.

Thus, in the present draft, any detailed considerations of experimental exercises are put off, until the CCD has considered the Group's final report and decides to continue activity on seismological data exchange by convening this, or a similar, Group to plan an exercise or an operational system.

Attempts were made by the U.S. and Japanese experts, in private discussions with the Soviet experts, to ascertain whether the Soviet Union would agree to participate in an experimental exercise, or some form of routine data exchange, prior to a full treaty being in force. The answer is not clear but there may be some circumstances under which they would agree to do so. If not, there is a further question of whether the CCD can, or would, authorize preparations for, and tests of, international data exchange, prior to the treaty, if one of the co-chairmen will not participate.

Appendix - Yield

The latest draft of the Appendix on yield estimation distributed by the convenor (Dahlman, Sweden) in advance of the meeting was much

reduced from the former. All figures and tables and the section describing differences in magnitude-yield estimation between the U.S. and U.S.S.R. test sites were deleted. This draft was accepted with very little discussion.

It became clear in private discussions that the Swedish delegates have decided not to press any controversial items, now that the trilateral discussions on a CTB are under way. It was undoubtedly this that led to the much reduced version of the Appendix.

COMPLETION OF FINAL REPORT

The time schedule for the work to complete the first full draft of the final report is described in Conference Room Paper No. 34 (attached). The Scientific Secretary will compile the full draft on the basis of the present draft chapters and extra material and suggestions resulting from the discussions. The chairman has agreed to act as convenor for drafting of the Summary and remaining portions of the Introduction. It is expected that the non-technical Summary will be about five pages in length, the main body of the report about fifty pages, with the Appendices following.

It is expected that the first full draft will be available in Ottawa approximately October 10, after which there will be about four weeks for a full review within EMR and DEA. The second full draft, modified by the Scientific Secretary on the basis of comments received, should be available before the end of December. This draft will form the basis for the final discussions at the last meeting of the Group scheduled for 27 February to 10 March in Geneva.

It is estimated that the CCD Secretariat will require about one month to prepare the final report in the four languages. It should

be submitted to the CCD by mid April.

SEISMOLOGICAL VERIFICATION

There have been no formal discussions in the Group of how the seismological information made available to all States by international cooperative measures, such as those described in the Group report, might eventually be used in a treaty situation for purposes of verification. This subject was not, of course, within the terms of reference of the Group's discussions. Neither have any of the private discussions revealed clear views on this subject from, for example, the U.S. and Swedish experts. What we know of the positions of these States has been evident for some time. The U.S. will rely primarily on global data available to them from their own seismological monitoring systems, but continues to believe that verification will not be adequate without some form of on-site inspection. It is not clear how the availability of data from Soviet stations in the global network discussed by the Group would influence the U.S. position on internal stations in the trilateral discussions.

Sweden has been engaged in a modest seismological monitoring program for some years and was the principal advocate of the Group's work to achieve a more rigorous and routine exchange of seismological data for purposes of verification. One can only assume that Sweden would commit its own resources for national analyses of seismic events using global data under a CTB.

In statements to the CCD, the Swedish and Japanese delegations have suggested a "consultative committee" and a "verification committee", respectively, as a body authorized to act on verification and other issues related to the compliance with a CTB, once in force. In private

discussions with Swedish and Japanese experts unsuccessful attempts were made to clarify the role of these committees. The Swedish consultative committee is composed of those States signatory to the treaty under the chairmanship of the U.N. Secretary-General. This committee would be convened at the request of any member to discuss issues relating to the treaty; this presumably includes a violation suspected on the basis of seismological analysis. The make-up of the Japanese verification committee, as described to the CCD, was less clear but appeared to have within its mandate the analysis of seismological data for purposes of verification. This concept apparently came from the Japanese foreign office without previous reference to Japanese seismologists, at least not to Dr. Suyehiro who represents Japan in the Group of Experts. There are many unanswered questions concerning the make-up of such a committee and the procedures to be employed to decide on and act on suspected violations.

Many of these issues should be clarified as trilateral and CCD discussions of a CTB proceed.

SUMMARY

There will be an opportunity in a few weeks time to assess the Group's report in the first full draft. It is therefore not useful to attempt a detailed summary discussion on the basis of the currently available isolated draft chapters. It is, however, probably fair to state that the final report will not present any striking revelations to the seismological community. It will likely be a consensus document with no dissenting views expressed; compromise has been used in many cases to avoid conflicting views. It will be written to the degree

possible to be understandable to CCD delegates. It is tempting to state that the most important aspect of the Group's work has been the "visibility" of a group of two dozen seismologists, from east, west and non-aligned States, engaging in extensive discussions over two years and achieving a consensus view on international seismological data exchange for purposes of assisting states to identify seismic events under a CTB.

The Canadian concerns following the third (April) meeting of the Group related to the time frames for data exchange, the extensive nature of the data suggested for exchange, the implications of full scale tests of the cooperative system, and the extra resources that would be required in Canada to participate. All of these concerns will be reconsidered in relation to the wording in the final report, but the current understanding of these issues is as follows.

The final report will be written in such a way as to accommodate the procedures and time frames of data derivation and dispatching described for potential contributing Canadian stations in GSE/CAN/4. The types of data that will be suggested for exchange will likely be described in quite general terms, emphasizing identification data but leaving details to the contributing national agencies. In private discussions with the U.S., U.K. and Swedish experts it became clear that they did not wish the final report to suggest any screening of events, by location or magnitude, for which station data would not be derived. Thus the problem of large earthquakes swamping the data exchange system remains, in principle, and will not likely be resolved until the full exchange system is tested.

Detailed consideration of extensive or full scale tests of the data exchange system will depend on a CCD decision to implement such a system. The form that this will take should become clear on the basis

of progress in the trilateral discussions and/or CCD discussion of the Group report during the summer of 1978. It is conceivable that a CCD-convened discussion of an operational system could start in late 1978, and it would be valuable to identify extra resources required in Canada in the 1979-80 program forecast. A reassessment of the Canadian resource requirements for this purpose will be made by the Earth Physics Branch during the next two months.