



UNITED NATIONS
GENERAL
ASSEMBLY



Distr.
GENERAL

A/7967/Add.1
24 April 1970

ENGLISH

ORIGINAL: ENGLISH/FRENCH/
RUSSIAN

Twenty-fifth session

URGENT NEED FOR SUSPENSION ON NUCLEAR AND
THERMONUCLEAR TESTS

Information relating to the creation of a world-wide
exchange of seismological data

Note by the Secretary-General

Addendum

For the period from 30 March to 22 April 1970 the Secretary-General had received, in response to his letter dated 30 January, communications from eleven States, the substantive portions of which are reproduced below.

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BURUNDI

[Original: French]
19 March 1970

"... Burundi does not possess a seismograph and ... there are no seismograph stations or array stations in its territory."

CANADA

[Original: English]
16 April 1970

In accordance with resolution 2604 A (XXIV) adopted by the General Assembly at its 1836th plenary meeting, on 16 December 1969, the following material on Canadian seismic stations and seismic information is appended in accordance with and following the notation of the annex to the resolution.

A. Conventional seismograph stations

Tables I, II and III contain the station name, the station code, the name and address of the operating organization in Canada, the co-ordinates and elevation of each station, summary material on the station foundation, and operational magnification at 1-second periods for short-period seismographs and at 20-second periods for long-period seismographs. The stations listed constitute the first-order seismic network of the Government of Canada; no broad-band seismographs are in routine operation.

All photographic seismograms are fully annotated with a time precision of +0.1 second. All records are photographed in Ottawa on a 35 mm flow camera, and a 35 mm copy of each record is deposited in the Seismological Data Centre,

National Weather Records Centre,
Federal Building,
Asheville, North Carolina 28801,
USA,

which provides copies of Canadian seismograms at cost to any and all bona fide requestors in the international seismological community. Because of the distances

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involved and staff shortages, deposition of photo copies with the Data Centre is usually about three months in arrears of the date the seismograms are acquired.

Since equipment and manpower are not currently available for extensive further duplication of records, our intention would be to continue the economic, effective and complete record copy flow to the Data Centre, as described above, and meet governmental demands for only very limited numbers of record copies by using facilities in Ottawa. These latter demands would be met within a time window of between six weeks and three months, depending upon the extent of a governmental request.

Table I lists seismographic stations of the Government of Canada, operated by personnel of the Earth Physics Branch, Department of Energy, Mines and Resources. Present plans call for the indefinite operation of these stations with continuous seismic recordings, although personnel shortages, isolation, logistical, vacation, power and other problems produce occasional unpredictable and unavoidable periods of record loss.

Table II lists seismographic stations of the Government of Canada, operated by personnel of other government departments for the Earth Physics Branch, Department of Energy, Mines and Resources. Present plans call for the indefinite operation of these stations with continuous seismic recordings, but programme priorities in other departments, personnel shortages, isolation, logistical, vacation and other problems produce occasional unpredictable and unavoidable periods of record loss.

Table III lists seismographic stations of the Government of Canada, operated by Canadian universities under contract to the Earth Physics Branch, Department of Energy, Mines and Resources. Present plans call for the indefinite operation of these stations with the same caveats as for those in table I. In addition, since the universities have the right to discontinue the contract arrangement, it is possible in principle that a hiatus in recording can occur whilst alternative arrangements are authorized and implemented.

Appendix A provides complete response curves (1 April 1970) for the three short-period seismographs and the three long-period seismographs at the twenty seismic observatories listed in tables I to III. It is the practice of the Government of Canada to publish annually in the Seismological Series of the Earth Physics Branch, Department of Energy, Mines and Resources, a Seismological Bulletin

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with, among other information, complete details of station and instrumental changes. The issue for any calendar year is usually published about one year later, and is available free of charge on request by governmental organizations to the operating organization in Canada.

B. Array stations

1. Name: Canadian Government Yellowknife Seismic Array - YKA.

Operated by: Seismology Division
Earth Physics Branch
Department of Energy, Mines and Resources
Carling Avenue
Ottawa 3, Ontario, Canada

2. Location: The array and recording facilities are located in a 500 sq km area immediately west of the town of Yellowknife in the Northwest Territories, Canada. Geographical co-ordinates and elevations of all elements are given in appendix B.

3. Geometry: The array consists of nineteen vertical cylindrical steel liners (vaults) emplaced and cemented into shallow pits blasted in Precambrian granite. Each vault contains one short-period seismometer and associated electronic transmission equipment. The vaults are laid out on two orthogonal lines, oriented north-south and east-west, with one common vault at the crossover point and all other vaults positioned at intervals of 2.5 km along the lines. A map of the array is given as appendix C, showing distances, directions and nomenclature.

4. Instrumentation: Each seismometer is a critically damped Willmore MK II with period set at 1 second. Preamplifiers and amplitude-modulated tone generators in the vaults prepare the seismic signals for transmission over elevated cables to the recording laboratory (see map, appendix C). There they are demodulated, filtered, attenuated if necessary, and recorded in frequency-modulated form on 24-track, 1 inch wide, 1 mil analogue magnetic tape. The centre frequency is 270 Hz, and the maximum deviation $33\frac{1}{3}$ per cent, corresponding to a 5-volt signal and a nominal ground velocity of 5×10^{-5} cm/s at 1s period. The 24 tracks consist of 19 signal channels, 1 time channel, 2 error correction channels and 2 spares. Recording is carried out at 0.3 inch/second, and the 7,200-foot reels are changed every seventy-two hours. The time code is a VELA-Uniform one-second coded signal

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supplied by a Geotech T-12 local time generator whose output is kept within 20 ms of WWV by daily radio checks. A simultaneous visual helicorder recording is made of one of the nineteen field signals.

Pulse calibration of the instrumentation for each channel is carried out daily and all pulses are recorded on the proper channel of the tape and helicorder. The gain is adjusted as required to ± 3 db tolerance. A typical response curve for any channel in the array is shown in appendix D. Over-all mid-band gain onto the tape in a typical channel test is 27.5 K.

5. Geology: The entire array lies in the Slave geological province of the Canadian Shield. A strip of ancient volcanics a few kilometres wide running north-south along the west side of Yellowknife Bay contains the gold deposits of the Giant and Con mines. West of this narrow belt are large granitic areas with little prospect of economic mineralization. The array is situated on this granite. To the east of Yellowknife Bay is a large body of highly contorted and metamorphosed sediments with some granitic zones. Throughout the entire area there are two major swarms of diabase dykes, one trending north-north-east, the other west-north-west. A large and complex fault system exists to the east and north of the town of Yellowknife, the faults trending mainly north or north-north-east but joining, splitting up and changing direction in an apparently random fashion. Many extensive linears appear in the granite area west of the town, but these are believed to be part of a joint system of eroded diabase dykes, rather than faults. The seven-year history of the array indicates that the area is virtually aseismic.

Because of the geology of the area, the topography is rough, although of low relief. West of Yellowknife the Shield rocks rise abruptly from Great Slave Lake to a height of 10 to 20 metres, then level off in average elevation, rising only a further 30 metres in the next 30 kilometres to the north of the lake. Within this area, however, granite cliffs of 5 to 10 metres are common, owing to the presence of the joints and eroded dykes already mentioned. The exposed rock is also fairly rough, due to spalling. Rock exposure varies from about 50 to 70 per cent as one proceeds north from Great Slave Lake, the rest of the area consisting of muskeg or small lakes. There are local stands of fairly large trees, but most of the vegetation in the area, apart from the muskeg, consists of low scrub and birch. It has been shown that the crust in the immediate vicinity of the array is very uniform;

a layer with an intercept time of 0.17 s is underlain by a 6.04 km/s layer extending to a depth of about 34 km. No evidence for an intermediate layer has been found. The M discontinuity has no significant over-all slope, but small-scale relief probably exists throughout the area under the array. This uniform and horizontal crust extends at least 70 kilometres to the north-west. To the east and south-east, some tens of kilometres away from the array, the crust is heavily faulted. However, the distances from the array are such that even for critically refracted rays the effects should be negligible.

6. Availability of data: No special systems for the transmission of data from Yellowknife to Ottawa have been developed, so at present it can only be guaranteed that magnetic tapes will be available in Ottawa within two weeks of being recorded. No facilities exist in Canada for making 24-channel FM magnetic tape copies and the Government of Canada cannot at this time undertake to loan or give the original tapes to anyone, nor are these tapes deposited in any international data centre.

The Ottawa laboratory has facilities for making analogue copies of selected channels on 7 or 14 track IRIG tape. At present the original tapes are available in Ottawa for a period of at least six months before being erased and reused at Yellowknife.

Digital tape copies of array data can be provided at cost for a limited number of events for a limited number of governmental requests any time during the period the original tapes are in Ottawa, when staff is available. Selected portions of any analogue tape can be digitized, with 12 bits, including sign, per sample, and transferred without further filtering to a 7-track IBM-compatible digital tape. Packing density can be 556 or 800 bits/inch. In our present format, the data are in binary notation (odd parity). Blocks (records) are 1,800 frames (characters) in length with longitudinal and lateral parity. Inter-record gaps are 3/4 inch. A file can be any length to the limit of the digital tape reel, and a BCD label can be written at the beginning of each file (event). The A/D sampling rate is 20 times per second simultaneously across all nineteen data channels plus the time channel. Digitization is carried out at four times real-time speed, being limited by the FM demodulators presently installed. One hour of real-time analogue array data is transcribed to digital tape in fifteen minutes (disregarding setup time) and occupies 400 feet of digital tape at 800 bits/inch.

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7. Emergency Back-up Facilities: It should be noted that there are no back-up facilities for the array or computer, and statements regarding availability of data are contingent upon a continuing low breakdown rate for both the array and the Ottawa processing laboratory, and the recruitment and training of personnel to meet any significant demand.

8. Improvements to the Yellowknife Seismic Array: A tripartite, high-gain, long-period vertical seismometer network is currently being installed at Yellowknife. Two out of the three stations are operational on an experimental basis with the radio-telemetered links, system gains and pass-band and magnetic recording still on an experimental basis.

This development should be completed during 1970 and data from this small long-period array will be made available in a manner approximately analogous to that described above.

Appendices A-D

[Appendices A-D to the above communication - containing detailed information on Canada's seismic stations, namely: complete response curves for conventional seismograph stations; geographical co-ordinates and elevations of all seismometers of Yellowknife Seismic Array; map of the Array; response curve for Array channel - are deposited in the archives of the United Nations and interested delegations may consult them upon request.]

TABLE I

NAME OF STATION	NAME AND ADDRESS OF OPERATING ORGANIZA- TION	LATITUDE	LONGITUDE	ELEVATION	GEOLOGICAL DESCRIP- TION OF STATION FOUNDATION	MAGNIFICATION OF SHORT PERIOD SEISMOGRAPHS AT 1 sec PERIOD (1/4/70)			MAGNIFICATION OF LONG PERIOD SEISMOGRAPHS AT 20 sec PERIOD (1/4/70)		
						Vertical	N - S	E - W	Vertical	N - S	E - W
Alert, N.W.T. (ALE)	Seismology Division Earth Physics Branch Dept. of Energy, Mines & Resources Carling Avenue Ottawa 3, Ontario Canada	82°29'N	62°24'W	65m	Permanently frozen glacial debris overlying Palaeo- zoic limestone	60K	66K	66K	3.7K	3.2K	3.4K
Baker Lake, N.W.T. (BLC)		64°19'N	96°01'W	16m	Granite gneiss	26K	29K	30K	3.8K	4.0K	3.8K
Fort St. James, B.C. (FSJ)		54°26'N	124°15'W	772m	Palaeozoic sediments	29K	30K	30K	2.0K	2.0K	2.0K
Great Whale River, P.Q. (GWC)		55°17'N	77°45'W	8m	Granite gneiss	28K	28K	28K	4.0K	4.3K	4.3K
Mould Bay, N.W.T. (MBC)		76°14'N	119°22'W	≈15m	Permanently frozen regolith and soli- fluxion deposits overlying Devonian sandstone	72K	76K	76K	3.6K	3.6K	3.8K
Ottawa, Ont. (OTT)		45°24'N	75°43'W	83m	Boulder clay on limestone	24K	23K	24K	3.2K	3.2K	3.0K
Penticton, B.C. (PNT)		49°19'N	119°37'W	550m	Tertiary shale	25K	102K	102K	2.6K	2.5K	2.6K
Resolute, N.W.T. (RES)		74°41'N	95°54'W	≈15m	Early Palaeozoic limestone	60K	60K	60K	3.2K	3.1K	3.1K
Seven Falls, P.Q. (SFA)		47°07'N	70°50'W	232m	Precambrian base- ment rocks	21K	8.5K	8.5K	1.8K	1.7K	1.6K
Victoria, B.C. (VIC)		48°31'N	123°25'W	197m	Quartz diorite	22K	27K	20K	1.9K	2.1K	2.0K
Yellowknife, N.W.T. (YKC)		62°29'N	114°29'W	198m	Granite	44K	38K	47K	2.2K	2.7K	2.3K

TABLE II

NAME OF STATION	NAME AND ADDRESS OF OPERATING ORGANIZA- TION	LATITUDE	LONGITUDE	ELEVATION	GEOLOGICAL DESCRIP- TION OF STATION FOUNDATION	MAGNIFICATION OF SHORT PERIOD SEISMOGRAPHS AT 1 sec PERIOD (1/4/70)			MAGNIFICATION OF LONG PERIOD SEISMOGRAPHS AT 20 sec PERIOD (1/4/70)		
						Vertical	N - S	E - W	Vertical	N - S	E - W
Churchill, Man. (FCC)	Seismology Division Earth Physics Branch Dept. of Energy, Mines & Resources Carling Avenue Ottawa 3, Ontario Canada	58°46'N	94°05'W	39m	Precambrian sedi- ments and vol- canics	36K	36K	35K	4.1K	4.0K	3.8K
Flin Flon, Man. (FFC)		54°43'N	101°59'W	339m	Granite gneiss	39K	39K	40K	4.2K	4.0K	4.2K
Frobisher, N.W.T.* (FBC)		63°44'N	68°28'W	45m	Precambrian metamorphic rock	32K	39K	38K	2.6K	2.4K	2.6K
Inuvik, N.W.T. (INK)		68°17'N	133°30'W	≈40m	Cambrian lime- stone	68K	59K	70K	3.1K	3.2K	3.2K
Port Hardy, B.C. (PHC)		50°42'N	127°26'W	33m	Triassic sedi- ments and vol- canics	14K	30K	32K	1.9K	2.1K	1.9K
Suffield, Alta. (SES)		50°24'N	111°02'W	770m	Competent sand- stone	42K	41K	44K	3.5K	3.5K	3.4K
* The site of this station is being moved a short distance in 1970-71: new station coordinates and elevation will be published in the Seismic Bulletin for 1971 or 1972.											

TABLE III.

NAME OF STATION	NAME AND ADDRESS OF OPERATING ORGANIZA- TION	LATITUDE	LONGITUDE	ELEVATION	GEOLOGICAL DESCRIP- TION OF STATION FOUNDATION	MAGNIFICATION OF SHORT PERIOD SEISMOGRAPHS AT 1 sec PERIOD (1/4/70)			MAGNIFICATION OF LONG PERIOD SEISMOGRAPHS AT 20 sec PERIOD (1/4/70)		
						Vertical	N - S	E - W	Vertical	N - S	E - W
Saint John's, Newfoundland (STJ)	Seismology Division Earth Physics Branch Dept. of Energy, Mines & Resources Carling Avenue Ottawa 3, Ontario Canada	47°34'N	52°44'W	62 m	Precambrian siliceous mudstone	8.4K	9.5K	9.1K	0.9K	0.8K	0.9K
Schefferville, P.Q. (SCH)		54°49'N	66°47'W	540 m	Competent Precam- brian slate-shale	29K	38K	46K	3.0K	2.9K	2.7K
Thunder Bay, Ont. (LHC)		48°25'N	89°16'W	196 m	Precambrian iron formation	23K	23K	26K	2.8K	2.3K	2.6K

GREECE

[Original: English]
31 March 1970

"... herewith [is] the information required by General Assembly resolution 2604 A (XXIV), concerning Greek seismic stations, which has been drawn up by the Seismological Institute of the National Observatory of Athens:

The National Seismological Stations Network of Greece is operated by the National Observatory of Athens, Seismological Institute, Athens, and consists of the Central Station of Athens and six half-unmanned satellite stations in Epirus (Jannina), Chalkidike (Polygyros), and on the islands of Cephalonia (Valsamata), Crete (Vamos), Rhodes (Archangelos) and Lesbos (St. Paraskevi).

Name and co-ordinates of station, elevation foundation, instrumentation components, operational period, magnification and speed of recording are listed below in a tabular form.

Name of station foundation	Co-ordinates elevation	Instrumen-tation	Compo-nent	Opera-tional period	Magnif-ication	Speed of recording mm/min
Athens (ATH)	37° 58' 20" N 23° 43' E	Benioff	Z	1.0	12,500	60
Cretaceous Limestone	h = 95 m	Sprengnether	N,E	1.0	12,500	60
		"	Z	14.9	1,500	15
		"	N,F	14.8	1,500	15
Archangelos (ARG)	36° 12' 58" N 28° 07' 34" E	Sprengnether	Z	0.5	45,000	60
Sandstone	h = 170 mm	"	N	0.5	15,000	60
		"	E	0.5	12,000	60
Jannina (JAN)	39° 39' 24" N 20° 51' 03" E	Sprengnether	Z	0.5	41,000	60
Cretaceous Limestone	h = 540 m	"	N	0.5	8,500	60
		"	E	0.5	6,000	60
Paraskevi (PRK)	39° 14' 46" N 26° 16' 18" E	Sprengnether	Z	0.5	45,000	60
Rhyolite	h = 100 m	"	N	0.5	8,000	60
		"	E	0.5	7,000	60
Polygyros (PLG)	40° 22' 25" N 23° 26' 44" E	Sprengnether	Z	0.5	100,000	60
		"	N	0.5	8,000	60

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Name of station founda- tion	Co-ordinates elevation	Instrumentation	Compo- nent	Opera- tional period	Magnif- ication	Speed of recording mm/min
Valsamata (VLS)	38° 10' 38" N 20° 35' 23" E	Sprengnether "	Z N	0.5 0.5	54,000 13,000	60 60
Cretaceous Limestone	h = 375 km	"	E	0.5	11,000	60
Vamos (VAM)	35° 24' 25" N 24° 11' 59" E	Sprengnether "	Z N	0.5 0.5	50,000 6,000	60 60
Marly	h = 225 km	"	E	0.5	11,000	60

Greece could provide fully annotated records of the Central Station of Athens, including the precision of the time, within six hours and those of satellite stations within ten days on demand. Copies of all records of the central station of Athens are available to everyone from the United States Environmental Science Services Administration. Copies of the records of the satellite stations could be deposited in a seismological centre provided the Seismological Institute will be allocated with the necessary funds."

GUYANA

[Original: English]
7 April 1970

"... Guyana has no seismic stations."

KUWAIT

[Original: English]
26 March 1970

"... there are no seismic stations in Kuwait at the present time... [The Government of Kuwait]... has consistently advocated the achievement of a comprehensive test ban. Hence... [Kuwait] favours the efforts being made for the eventual establishment of an effective world-wide exchange of seismological information."

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MALI

[Original: French]
14 March 1970

"... there are no seismic stations on the territory of Mali."

MONACO

[Original: French]
27 March 1970

"The Scientific Centre has a seismic station, the records of which have been analysed and have been filed in Monaco since 1955. All the technical data can be made available; on the other hand, experience has shown that, from the point of view of good record-keeping, it is not advisable to part with the original records.

It would seem to be preferable, therefore, to consider the transmission, on request of good quality copies obtained by means of an economic procedure that has a good power of separation but will not alter the scale of the document to be reproduced (a Xerocopy, for example).

The analysis of the records is carried out by the Scientific Centre, and the results are then transmitted to the International Seismological Bureau at Strasbourg, as well as to some twenty European observatories, thus making possible the establishment of international seismological records."

NIGER

[Original: French]
31 March 1970

"... there is no seismograph installed in Niger."

SUDAN

[Original: English]
20 April 1970

"... the Sudan does not at present operate such [conventional seismograph and array] stations."

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THAILAND

Original: English
26 March 1970

"... the Ministry of Foreign Affairs of Thailand has the honour to forward... information... on conventional seismograph stations of Thailand. As indicated in the attached paper, the availability of copies of data on certain dates from these stations can be made by the Thai Meteorological Department on request. There is not the provision of information about the array stations due to the fact that Thailand does not have such an instrument.

I. CHIANGMAI SEISMOLOGICAL STATION (Abbrev. CHG)

1. Address: Chiangmai Seismological Station
Division of Northern Region Weather Forecast
Chiangmai, Thailand
2. Operating organization: Meteorological Department
Office of the Prime Minister
Sukumvit Road
Bangkok 11, Thailand
3. Geographical co-ordinates: Latitude: 18° 47' 24" N
Longitude: 98° 58' 37" E
Elevation: 416.43 metres above mean sea level
4. Instrumentation:
 - Short period includes vertical-, north-south-, and east-west components with each of 400,000 magnification at 1 second period.
 - Short period's drum speed of recorder: 15 minutes per revolution.
 - Long period includes vertical-, north-south- and east-west components, with each of 3,000 magnification at 15 second period.
 - Long period's drum speed of recorder: 60 minutes per revolution.
5. Geological description:

The station is located on the foothill of a range of mountains, approximately 6.5 kilometres from the city of Chiangmai. These mountains around the station are part of a range extending into Burma, India and China. The local mountains are eroded and round. Situated below the station is the valley of the Mae Ping River,

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one of the four main tributaries of the Chao Phya River. The station's piers rest upon solid granite bedrock with relatively small noise.

6. Availability of data:

Original copies of daily data are regularly dispatched to the United States Coast and Geodetic Survey for microfilming, and later returned to the Thai Meteorological Department. Good quality copies of data on 30 x 90 cm² papers on certain dates may be made available if requests for them reach the Department before regularly shipping schedules of data.

II. SONGKHLA SEISMOLOGICAL STATION (Abbrev. SNG)

1. Address: Songkhla Seismological Station

Division of Southern Region Weather Forecast
Songkhla, Thailand.

2. Operating organization: Meteorological Department

Office of the Prime Minister
Sukumvit Road
Bangkok 11, Thailand.

3. Geographical co-ordinates: Latitude: 07° 10' 24" N

Longitude: 100° 37' 12" E

Elevation: 4.00 metres above mean sea level.

4. Instrumentation:

- Short period includes vertical-, north-south-, and east-west components with each of 25,000 magnification at 1 second period.
- Short period's drum speed of recorder: 15 minutes per revolution.
- Long period includes vertical-, north-south- and east-west components, with each of 3,000 magnification at 15 second period (1,500 during peak of microseism).
- Long period's drum speed of recorder: 60 minutes per revolution.

5. Geological description:

The station is located near the root of peninsular, 4 kilometres southeast from the town of Songkhla. About 1 kilometre to the northeast of the station lies the beach connecting the South China Sea. About 4 kilometres to its west is the shore of the Songkhla Lake. The station sits in a low range of granite hills. A small stream passes about 200 metres to the north. The station is near

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the shore of the Gulf of Thailand, off the South China Sea, about 800 kilometres due north of Bangkok, and 800 kilometres north-northwest from ~~Sing~~apore. The station is roughly half-way down the Malaysia peninsular, only about 60 kilometres north of the Malaysia border. The peninsular is mostly low, and alluvial land with a few low hills of granite.

6. Availability of data:

(Same conditions as in I-6)"

UKRAINIAN SOVIET SOCIALIST REPUBLIC

Original: Russian
20 April 1970

"The Government of the Ukrainian Soviet Socialist Republic has consistently supported the effort to achieve an early agreement on the banning of underground nuclear weapon tests. It considers that the achievement of such an agreement should be based on the use of national means of detection to control the banning of the above-mentioned underground tests, since the level of development of modern science and technology makes it possible to effect such control by using national means of detection.

This control would also provide a guarantee for all States that an agreement on the banning of underground nuclear weapon tests would be conscientiously implemented by all parties.

In view of the foregoing, the Government of the Ukrainian SSR considers that there is no need to have recourse to the international exchange of information on seismic stations.

In this connexion the Government of the Ukrainian SSR would also like to draw attention to the fact that the assertion by some Powers that there is a need for international control of the banning of underground nuclear weapon tests is, in the light of the above, without any foundation whatever."
