Geophysicists in Moscow: Signs of Easier Relations

Science editor Philip H. Abelson attended the 15th general assembly of the International Union of Geodesy and Geophysics in Moscow on 1 through 14 August. There he served as principal U.S. delegate to the International Association of Volcanology and Chemistry of the Earth's Interior. In preparing the following notes for publication, he checked his own impressions extensively against those of American scientists who participated in other sections of the meeting, and against the impressions of those who visited scientific institutions in the Moscow region.

A major change in Soviet-U.S. relations may be in process. This was the impression of a group of Americans who attended an international meeting of geophysicists in Moscow. Geophysicists are occupationally attuned to nuances of politics, for much of their work is global in character. They need international cooperation in many endeavors. Among the U.S. delegation to Moscow were men who have had many contacts with the Russians. They could readily compare present circumstances with those of other occasions. At the comparable Helsinki meeting of 1960, Russian delegates avoided contacts with other scientists. They were lodged in a separate hotel and came and went in groups. Americans believed that a substantial fraction of Russians in attendance were secret agents whose duty was to watch the actions of the Russian scientists.

Changes Noted

In the recent meeting, geophysicists noted substantial changes in the attitudes and behavior of their Russian colleagues. To an extent not previously possible, Americans were entertained professionally and socially and were invited to visit Soviet research facilities. Only a few Russians would be so bold as to act counter to official policy in their contacts with foreigners; therefore, the extent of the hospitality reflected national policy.

The experiences of the geophysicists are not an isolated occurrence. During a 2-week stay, I encountered representatives of three American groups that were or had recently been conducting negotiations with the Russians on matters of scientific or technological cooperation. All of my contacts occurred quite by accident. I became aware of extensive negotiations on collaborative efforts in space when I met part of an American team while strolling through Red Square at midnight. While visiting an Intourist office one afternoon, I met Walter Orr Roberts, who informed me of another group that had conducted significant discussions with Russians on environmental and other matters. While standing in line at a buffet to get breakfast, I fell into conversation with a member of the Alaska branch of the U.S. Geological Survey. He was in Moscow at the invitation of the Russians to discuss collaborative work on arctic geology. All of these people were optimistic about the prospects of a constructive outcome for their negotiations.

In addition to these encounters, during a courtesy visit to the American Embassy I was told of the forthcoming visit to the U.S.S.R. of a team of nuclear experts headed by Glenn Seaborg. They are to explore possibilities of U.S.-U.S.S.R. cooperation in high energy physics and other matters. Subsequently, I learned of a visit to the U.S.S.R. on 18 through 20 August of a high-level group of scientists headed by Paul Doty. They were there at the invitation of the Russians and were participating in sessions of an informal study group sponsored by the Soviet Academy of Sciences and the American Academy of Arts and Sciences. Their agenda was not publicized, but on other occasions it has dealt with arms control.

The International Union of Geodesy and Geophysics now conducts meetings at 4-year intervals. Previous sessions were held in Zurich, 1967; Berkeley, 1963; Helsinki, 1960; and Toronto, 1957. The most recent general assembly of the Union (the 15th) was held at Moscow University with about 3500 persons in attendance, of which around 350 were Americans. The Union is comprised of seven associations. These deal with geodesy, geomagnetism and aeronomy, the geophysics of the solid earth, volcanology and the chemistry of the earth's interior, oceanography, hydrology, and meteorology. Each association is relatively autonomous, with its own set of officers, commissions, and committees. The style of operation and the degree of international cooperation within the purview of an association is variable, depending in part on the kind of geophysics involved and in part on the personalities of the presidents and, especially, the general secretaries. During the interval between general assemblies, the associations, commissions, and committees carry on international cooperative work and organize meetings and symposia. These meetings are held in many different countries. Thus geophysicists are among the world's most traveled scientists, and they establish warm friendships with their counterparts in many nations.

Renewing Old Contacts

The occasion of a general assembly represents a great and pleasant gathering of the clans—a time of renewal of valued old contacts and an opportunity for new acquaintanceships. The scientific program is substantial and consists of many interassociation symposia. But the real value of the assemblies lies in the opportunity to gauge and meet people and to interchange scientific and technical information and ideas in an informal setting. This is particularly true of contacts with the Russians. It is not very practical for an American to engage in a long, transatlantic telephone conversation with his counterpart. Letters are often unsatisfactory as a means of communication. Air mail delivery to a Russian scientist usually requires 3 weeks or more. An international meeting represents an extremely good opportunity for effective communication.

Much of the tone and spirit of the assembly was set by the good quality of the arrangements made by the local organizing committee. Foreign delegates were housed in the best hotels in Moscow. They were transported to and from Moscow University in free buses that ran frequently. The opening session of the assembly was held in the magnificent Palace of Congresses, which is located in the Kremlin. This hall seats 6000 and has facilities for

the transmission of talks in 14 languages. Delegates were greeted by a number of Russian dignitaries, who largely eschewed propaganda and spoke mainly of the desirability of friendly and useful international cooperation in a peaceful world. The scientific sessions were conducted at the University (it has 60,000 students, most of them on vacation). There were an adequate number of spacious meeting halls. The Russians delivered practically all of their papers in English. For wives and for those who wished to take a break from sessions, there were several free sightseeing tours of Moscow each day. For working scientists there were a number of formal tours of facilities and, more important, many informal arrangements of such tours. Midway through the conference there was a sumptuous reception for all the foreign delegates at one of the better facilities of Moscow.

Cautious in Assessments

Geophysicists were, of course, pleased with the circumstances of the meeting and its aura of relaxed tensions. Having had other experiences, they were inclined toward some caution in their assessments. After all, when good fellowship can be turned on, it can also be turned off. Experiences of Americans who have attempted to foster cooperation in space activities, for example, illustrate this point and underline some of our problems in dealing with the Russians.

During the Sputnik era of 1955 to 1962, the United States made repeated overtures suggesting cooperation in space activities with little success; and when agreements were reached, these were not always fully implemented. Presumably the Russians felt that they were ahead of us and would lose rather than gain from cooperation. After the successful Glenn flight in 1962, another overture was made by President Kennedy. This led to more fruitful negotiations, with each side nominating technical delegations that consulted on possible cooperative efforts. Among the results was an agreement to pool information from meteorological satellites with daily, two-way transmission of cloud covers. This agreement was honored, but Americans were not entirely satisfied with Russian performance.

During the period from 1965 to 1969, the cooperative relationship lapsed. Correspondence was not answered and regular meetings were not held. The United States nevertheless persisted in attempts to draw the Russians into cooperative ventures. They were invited to attend Apollo launchings and to visit our space installations. In 1969 M. V. Keldysh, president of the Russian Academy of Sciences, finally responded, saying that cooperation had been only limited and should be improved by more meetings. This suggestion has been carried out. The meetings led to an agreement to develop designs of compatible rendezvous and docking systems. Signed in October 1970, the agreement has been implemented, and the Russians have made strenuous efforts to maintain the schedules. About 20 engineers on each side have been meeting. The working groups have met to define elements of the required designs. They do not attempt to arrive at identical designs, but rather at compatible ones. The last meeting of the working groups was held in Houston in June 1971.

Another agreement, reached in January 1971, was to explore scientific and practical collaboration in space. This led to a meeting that took place in Moscow during the week of 2 August and involved a United States delegation of about 20 scientists or technical people. Items under discussion were cooperation in (i) near-earth space, the moon, and planets, (ii) earth resources survey with air-ground correlation, (iii) space biology and medicine, and (iv) meteorology, including satellites and sounding rockets.

The U.S. team felt that negotiations were going well and were by far the most useful they had participated in. Both sides avoided politics, even during the numerous social events. As scientists and technical people, they found that they shared many common viewpoints. The two delegations got along very well together. Their discussions were specific and searching. Details of the agreements reached will be announced within 2 months.

In comparison to the red-carpet treatment accorded the space negotiators, the average American geophysicist attending the international meeting did not fare so well. After their visits to Russian facilities, these American scientists came away with a spectrum of reactions ranging from disappointment to mild approval. Most of those who visited such facilities went as part of a group tour. At some of the installations, the visitors were ushered into conference rooms, where they were told about work being conducted at the facility. In some instances, they were disappointed when they did not see any actual apparatus. At other spots, notably the Seismological Observatory at Obninsk, the group were freely shown seismological equipment and data processing facilities.

The treatment that Russians gave leading visiting geophysicists contrasted with that accorded the ordinary scientist-delegate. Leading scientists were given flattering attention and unusual opportunities to see equipment and to learn of new work in progress. They were generously entertained and invited to dine at private homes. The attitudes of Russians toward distinguished guests mirrors their behavior toward each other and the structure of the Soviet scientific enterprise. Academicians have great status and power, and usually are tough and realistic about the uses of their power. Underling scientists are kept in line and must be careful about the kind of initiatives they take. When scientists in the intermediate echelon are invited to travel abroad, they must clear the trip at many levels. Russian scientists often agree to exchange information with American counterparts and subsequently fail to deliver their end of the bargain. Usually the source of the failure is higher authority.

Scientists' Perquisites

Among the equals in the Soviet Union, some citizens are more equal than others. This is particularly true of those scientists fortunate enough to become academicians. It is difficult to estimate their income, for they enjoy perquisites in addition to their salaries, and many obtain royalties from books. Perquisites may include an auto with chauffeur, a dacha, and the privilege of patronizing certain special stores.

Based on their visits to facilities and on their experiences during scientific sessions, Americans left Moscow with the following impressions. Most Soviet scientists suffer from a lack of adequate, up-to-date equipment. As a result, their experimental geophysics at best matches ours and at worst is substantially inferior. Russians are particularly handicapped by inadequate electronic computing facilities. In contrast, several leading U.S. solid-earth geophysicists expressed admiration for the brilliance and imaginative approaches of the Russian theoretical work and felt that their theorists probably surpass ours.

In addition to their pleasant surprise at the quality of scientific aspects of their stay in Moscow, Americans

found that living conditions surpassed their expectations. Delegates approached Russia with misgivings. They had read that life in Moscow was grim and drab. They were uneasy about possible hostility of civilians or secret police. Instead, they encountered reasonably agreeable circumstances. The hotel accommodations were on a par with those of the United States or Western Europe. Women wore attractive clothes, styled a bit more conservatively than those of the West, but fully as varied in their patterns and colors. Many of the young women had resorted to cosmetic artifices to produce synthetic blonde or reddish brown hair. The typical Muscovite is somewhat agressive and inclined to snarl a savage *nyet* at his fellows. However, if anything, they were polite and good-natured with their visitors.

Communications Network

The American delegates quickly found that their life in Moscow was different from what they were accustomed to. Few had any facility with the Russian language. They felt cut off from the rest of the world. A few of the hotel personnel could understand some English, but most of the service people could not. Information on happenings in the United States was not readily available. Late arrivals from America were greeted with special enthusiasm, for they brought with them news. In a short time, Americans created an efficient communications network. They became proficient in sign language, while picking up a few essential words. The first day of their stay, the delegates hovered close to their hotel or to the university. Soon they were fanning out all over Moscow on foot, in public buses, or on the Metro. Those staying at the Rossia Hotel (Europe's largest, 6000 beds) found that service at the restaurants there was slow and undependable, and the menu limited. Instead of complaining, they took their business elsewhere, often to the National Hotel where service and food were excellent. Most Muscovites spend a substantial fraction of their lives standing in lines, but with a little ingenuity, the privileged visitor could escape that annoyance.

Moscow has several features that are superior. The delegates felt safe on the streets at night. The underground Metro system is fast and dependable. Moscow streets are kept clean to a degree unmatched in the United States. Pedestrians do not disrupt traffic on

Court Decision Jolts AEC

The U.S. Court of Appeals for the District of Columbia issued on 23 July a decision that harshly criticizes the Atomic Energy Commission (AEC) for dawdling in its implementation of the National Environmental Policy Act (NEPA), which went into effect in January 1970.

The immediate effect of the decision has been to introduce new environmental elements into the licensing process for the construction of nuclear power plants. The upshot of the matter is that many plants, both operative and under construction, may have to install cooling towers and other costly devices to cut thermal pollution.

Three environmental groups precipitated the decision with a suit over the controversial Calvert Cliffs reactor now being built in Maryland on the Chesapeake Bay. The AEC responded with the announcement that it would review its licensing procedures and will come up with new guidelines "as soon as possible."

The court generally found the AEC to be delinquent in adhering to the intent of NEPA, saying the AEC's "crabbed interpretation . . . makes a mockery of the Act."

The decision outlined four specific criticisms: (i) the AEC did not require the independent hearing boards charged with reviewing its staff recommendations to consider environmental factors unless such factors were brought to the boards' attention by outside parties; (ii) the AEC's procedural rules prohibited an outside party from raising nonradiological environmental issues if notices for the hearings were posted before 4 March 1971—14 months after NEPA went into effect; (iii) the hearing boards, instead of conducting their own investigations, were taking the word of other federal, state, and local agencies that environmental requirements were being satisfied; and (iv) facilities that were issued construction licenses before NEPA went into effect were not subjected to further environmental review until it came time to issue an operating license—by which time "corrective action may be so costly as to be impossible."

The court dwelt at length on what it called the AEC's "abdication" to other agencies of its responsibilities under NEPA. By merely adhering to existing standards (such as federal-state water quality standards), said the court, the AEC has neglected to balance a broad range of environmental costs against the economical and technical benefits of nuclear power plants on the "case by case" basis the Act requires. As a result, the AEC has ignored the fact that in some cases the total environmental impact of a power plant might outweigh its benefits even if the plant were to comply with pollution regulations. Through this policy, the AEC has barred the public from raising a wide spectrum of environmental issues and has thereby "subverted" the Act, wrote the court.

The court had little sympathy for the commission's explanation that the long time lag between NEPA's enactment and AEC compliance was necessary to "accommodate transitional implementation problems" and that "unreasonable delays" in plant construction and operation must be avoided because of the "national power crisis."

Said the court: ". . . a transition, however 'orderly,' must proceed at a pace faster than a funeral procession." As for the power crisis, the court noted that the purpose of NEPA was to tell federal agencies that environmental protection deserved an equal footing with the promotion and regulation of industry. "The spectre of the national power crisis . . . must not be used to create a blackout of environmental considerations."

The court's decision is applicable to 88 units now under construction or in operation, and it excepts only the handful of plants that started operation before 1 January 1970. In a specific reference to the Calvert Cliffs plant, the court said the commission should "consider very seriously" halting construction, pending a new environmental review.

As of last week, the AEC was still considering the court's recommendations.—CONSTANCE HOLDEN

major streets; there are underpasses. The speed limit on major avenues is 80 kilometers per hour (50 miles per hour). Traffic moves fast; there are not many automobiles.

Moscow also has features that are not so attractive. The visitor is made to feel that he is being watched. On each floor of the Intourist hotels are "Den Mothers" who note the comings and goings of patrons. Several of the delegates received mysterious phone calls at night. I had six such calls. Another delegate's room was invaded repeatedly by "electricians" for no apparent reason.

Another unattractive feature is the lack of facilities catering to consumers. For decades the distribution of goods and services has been badly neglected. To buy a single item in Moscow's largest store, a customer must stand in three different lines. Clothing is at least as expensive as it is in the United States. An automobile costs three times as much. Although it is difficult to compare wage scales, their wages seem less than a fifth as high as ours. On the other hand, there is low-cost housing and free medical care.

Scientists who have visited Moscow on previous occasions were impressed with the changes in the appearance of the city and its people. Many old structures have been torn down and replaced by broad avenues and new buildings. Vast apartment complexes are being built on the outskirts of the city. On all sides, Muscovites can see change and progress. They do not have our affluence, but they feel that they are climbing upward.

Most of our delegates were careful to avoid politics and did not probe for explanations of the relatively cordial treatment they received. Some of the younger Russians chose to bring up the topic of China. They were apprenhensive of the forthcoming Nixon visit to China, and they were critical of the fact that their country had earlier assisted the Chinese in nuclear developments.

It is possible that the explanation for cordiality lies in another direction. While the United States and the U.S.S.R. have devoted tremendous sums to reaching a dangerous nuclear stalemate, Western Europe and Japan have enjoyed dynamic prosperity. Though possessing far less natural resources than Russia, they have achieved a better standard of living. For a generation, the Soviet propaganda machine could convince the citizens of the superiority of their system. But the propaganda is stale, reminiscent of a broken phonograph record. Today there is no visible sign of disaffection in Russia, but the government seems to be trying to avoid an increasing gap between the Russian standard of living and that of its neighbors. It can move more effectively in a friendly atmosphere than in a hostile one. In the improvement of the consumer aspects of their economy, the Russians could benefit substantially from technology transfer and from financial arrangements with the West.

The Russians move in ways that are not always understandable to us or to them. The recent experiences of scientists in Moscow may be a portent of something larger.

DNA Double Helix: Photo Sends Controversy Spiraling

Chicago. One scientific picture sometimes isn't worth much unless it is accompanied by 10,000 carefully researched words.

The *New York Times* was reminded of this on 12 August when it published "the first photographs clearly showing the twisted, double-stranded structure of DNA, the molecule that carries the 'code of life' " and a story on the front page of its second section.

By early afternoon, one of the main scientists cited, Albert V. Crewe, dean of the physical sciences division of the University of Chicago, called a press conference here and said, "I must categorically deny the photograph which appeared in the *New York Times* this morning as being that of a DNA double helix. . . . Second, even if it was, it would certainly not have been the first. Needless to say, we were not consulted before this article appeared in the press."

Crewe is a distinguished physicist who served as director of the Argonne National Laboratory from 1961 to 1967, where he directed much of the design and construction of the Zero Gradient Synchrotron. He was obviously very upset at the misrepresentation of the photograph taken with his powerful electron microscope.

He said he thought it necessary to publicly rebut the story because "My friends in the scientific community will think I'm an idiot. The next time I publish a picture, no one will believe it."

On the following day, the *New York Times* published Crewe's statement that the photograph was not of a DNA molecule in a less prominent place than the original story was published. The *Times* did not point out in its retraction that it had identified the photographs as the first taken of the DNA molecule. Reporter David A. Andelman of the *Times* said in a telephone interview that he had not been successful in his attempts to call Crewe before publication of the first story.

The scientist who originally gave the photograph and story to the *New York Times* was George Stroke, a professor of electrical sciences at the State University of New York at Stony Brook who also holds a visiting professorship in medical biophysics at Harvard. The photograph had been sent from Crewe's lab for processing in Stroke's lensless laser process.

In a telephone interview, Stroke said that he fully agreed with Crewe that the photograph was not of a DNA molecule and that, rather, it was a photograph displaying the double-helical structure of the "fd virus," which he said he had described to the *New York Times* as a "DNA-containing filamentous bacterial virus." Stroke said that he based his classification of the photograph as an fd virus on work done in Crewe's lab. Stroke described Crewe as "a good friend of mine" and emphasized that "there is no disagreement between us."

There does, however, appear to be some difference of opinion. In an interview, Crewe said that the photograph was probably one of a part of an fd virus but that he thought it was impossible to ascertain a double helical structure for the virus from only one