couraging students to obtain their doctorates four years after they receive their undergraduate degrees.

The report also suggests training grants—funds assigned to the institutions for award to students they have selected—should be emphasized as the device for channeling increased funds into EMP. The virtue of this method, it is argued, is that it will enable some of the less prestigeful, but still worthy institutions to attract students who might be inclined to go elsewhere if they receive support directly. And it further recommends that allowances to the universities to cover "true cost of education" should be raised above the $2500 per student now provided by the National Science Foundation and the Office of Education under the National Defense Education Act. Again, no figure is set forth, but the report notes that figures provided by the universities place their average costs at $3380 per fellow in the physical sciences and mathematics and $4020 in engineering.

To assure that adequate facilities will be available for the proposed increased enrollments, the report recommends the "strengthening" and wider geographic distribution of "educational centers of excellence," which it defines as "an entire institution, a department, a group of faculty, or one distinguished man." To help achieve this goal, it proposes that when other sources of funds are not available, insistence on 50-50 matching of funds for construction "be relaxed to enable the Federal government to contribute as much of the funds for a needed facility as may be necessary."

The report acknowledges that it is concerned with only a relatively small slice of the overall manpower situation. It notes, for example, that the production of highly trained graduates in EMP is a process with roots that run through all levels of the nation's educational system; and it also points out that the manner in which EMP graduates are utilized is probably as significant to the nation's needs as the number that are turned out.

However, as a short order recipe for achieving a quick, though modest increase in EMP graduates, the report has considerable merit. It is politically palatable, it is aimed at producing the increase with the least possible disruption for other specialized fields, and it could be readily integrated into existing patterns of federal support.

—D. S. GREENBERG

Cooperation in Space: U.S.—U.S.S.R. Accord Caps Year of Modest Gain

The carefully worked out agreement between the United States and the Soviet Union to cooperate in certain "peaceful uses of outer space" is regarded as a definite step ahead in international space cooperation, but is most unlikely to throw together American and Russian space scientists and engineers in the laboratory or at the launch site.

Formal announcement came early this month of agreements negotiated last spring by the two nations to cooperate in three fields: establishment of a global weather satellite system, mapping of the earth's magnetic field, and experiments with communication satellites. Working parties from the two countries will meet to plan the three projects and arrange exchanges of data, but the cooperation contemplated can be characterized more accurately as coordination than as a joint venture.

A summary of the agreement (Release No. 62-257) may be obtained from the National Aeronautics and Space Administration, Office of Public Information, 400 Maryland Ave., SW, Washington 25, D.C.

Quite understandably, however, this agreement between the only two satellite launching powers in the world is being closely examined for political significance. The decision by the Soviets and the United States to announce the agreement jointly in the United Nations and to request that the text be circulated as a U.N. document gave the news a certain cachet which probably added to the enthusiasm of the smaller nations, who like to see this kind of accord given an international aspect.

The U.S.–Soviet agreement is, in fact, a bilateral one negotiated outside the U.N. and quite similar in its essentials to cooperative arrangements for space experimentation worked out by the United States with a number of other nations, including Britain, Canada, and Japan.

Origins of the new space agreement can be traced back to faint beginnings in President Kennedy's disposition to discuss cooperation in space with the Russians, expressed in both his Inaugural address and his first State of the Union message. The Soviet Union, however, did not take the President up on his very general invitation until after Colonel Glenn's orbital flight, which may well have been regarded by the Russians as marking United States accession to full membership in the space club.

Khrushchev in his letter of congratulation on the Glenn flight, suggested that the U.S. and the U.S.S.R. might pool efforts to explore outer space. With diplomatic reflexes working at a speed that hinted anticipation, the President responded affirmatively in one day, and the United States followed up two weeks later with a list of proposals for possible projects.

Talks were held in New York in March, and delegations met again in Geneva for 10 days of talks which ended 8 June with the sending off of firm proposals to the Soviet Foreign Ministry and our State Department for approval. Chief negotiators were Hugh L. Dryden, deputy administrator of the National Aeronautics and Space Administration, for the United States and Academician A. A. Blagonravov of the Soviet Academy of Science for the Russians. The fact that Soviet scientists handled the negotiations virtually without interference from foreign-office officials led some American observers to believe that the agreement represented a victory for Russian scientists, who have been pressing for more contacts with scientists of other nations.

In August the State Department said the U.S. government had no objections. The crisis in the Caribbean in October may have delayed Soviet action on the proposals, but it appears that the only real effect was on timing.

On the basis of past performance the Russians are expected to carry out their part of the bargain. Ameri-

can officials experienced in dealing with the Soviets note that it is usually difficult to get the Russians to sign on the dotted line, but that in the case of agreements involving the reporting or exchange of scientific data they have a generally good record of performance. It is in the area of political agreements that East and West are likely to interpret both the letter and the spirit differently.

If other nations in the U.N. have been overdemonstrative in greeting the really quite modest agreement between the Americans and the Soviets, this is understandable in view of the deep anxiety over the prospects of the militarization of space, particularly the fear of hydrogen bombs whirling in orbit.

Military Implications

The American position on arming outer space can be summed up as a watchful "we won't do it if you won't" notice displayed chiefly for the benefit of the Soviet Union. In a speech at the U.N. in September of 1961, President Kennedy made a strong plea for international cooperation in the peaceful uses of space under U.N. auspices, and also proposed a general prohibition of weapon systems in outer space. No such prohibition has been voted, primarily because neither of the space powers seem to regard circumstances propitious for such a commitment.

Last summer the imputed military implications of Soviet success in placing two manned satellites in orbit and bringing them close together caused an outcry in such high places as the Senate for major increases in the American military space program. In September, in what was obviously a reaffirmation of administration policy, Deputy Secretary of Defense Roswell Gilpatric said in a speech, "we have no program to place any weapons of mass destruction into orbit."

There is no doubt, however, that the matter is one of those that is always "under study," as the saying goes. It is known that within the Air Force there is a feeling that a major effort is in order, particularly because public statements have indicated that within the Soviet military, in respect to space, there is agitation to get there first with the most.

The inevitable connection between the peaceful uses of outer space and the unpeaceful use was recognized by Khrushchev in his letter last March, when he said, "it seems to me obvious that the extent to which we can cooperate in the peaceful exploration of space, and the choice of those fields in which such cooperation is possible, will depend to a certain degree on the solution of the disarmament problem. Until an agreement is reached on general and complete disarmament, both our countries will still be limited in their ability to cooperate in the peaceful uses of outer space."

The United States has acknowledged the relevance of arms in space to the total disarmament problem by including a proposal, in current American proposals at the Geneva arms talks, to exclude weapons of mass destruction from outer space. However, the chief impediment to disarmament in the heavens as well as on earth continues to be the problem of verification and inspection.

In brief, the Soviets want disarmament in stages to be governed by detailed agreements between governments but not involving inspections, at least in the earlier phases. The United States position, from the outset, has been that secrecy is incompatible with disarmament, and presumably the recent events in Cuba reinforce that attitude.

The Soviet identification of secrecy with national security extends to its handling of its whole space program. By contrast, the United States, although it by no means operates an open-house policy on missile bases, has put much of the man-in-space program into the public domain and has issued special invitations to observers from other countries to come to selected launchings.

The Russians have never attended, though representatives of other Communist countries have, and it is assumed that the Soviets wish to avoid the suggestion that, since they came as guests, they might one day be hosts.

This Soviet reluctance to expose hardware to alien eyes is one obstruction to an arms control agreement for outer space, since any agreement involving inspection would mean that inspectors would have a look at space-bound Soviet payloads. And this same Soviet reticence is probably the main reason why togetherness on the part of Soviet and American scientists in the new space cooperation projects will be extremely limited.

On the other hand, the Soviet Union has been showing a willingness during the last year to share data and talk about space problems in general which has given the U.N. Committee on the Peaceful Uses of Outer Space a lease on life.

The space committee was created in December 1959 and actually did not meet until late November of last year. Its development was seriously retarded by political difficulties centering on the Soviet insistence on a so-called Troika organization for the U.N., with equal representation for Communist, Western and neutral nations. Differences over composition of the nascent committee prevented it from even being organized. Ungenerous observers add that the Russians were enjoying a lead in space activities in those days and simply were not very anxious to see the committee's work get under way, since they felt they had much more to give than to gain.

The impasse was ended last December when the Soviets backed a resolution in the General Assembly calling for the internationalization of space and for world cooperation in developing systems of weather and communication satellites.

Beginning in March, the space committee met and developed a series of proposals for international cooperation, involving the World Meteorological Organization and the International Telecommunication Union. One concrete result of these proposals may well be the establishment of an international sounding rocket facility on the equator to operate under U.N. sponsorship.

Disagreements Reported

An appeal for cooperation on these projects was included in a resolution sent last week to the General Assembly and given quick ratification. The same resolution expresses regret that the space committee has not been able to make recommendations on the legal questions connected with the peaceful uses of outer space and asks that all nations cooperate in the "further development of law for outer space."

This part of the resolution bears witness to what U.N. rhetoricians call the "juridical lag" in space. The U.N. space committee has two subcommittees, one to handle scientific and technical matters, the other to handle legal ones, and while the scientific subcommittee sent in a set of recommendations for

action, the legal subcommittee, in effect, could only report its disagreements.

Not surprisingly, the list of proposals made to the legal subcommittee shows that the main problems facing that subcommittee arise out of the sharp differences between the United States and the Soviet Union as to what space law should be and how it should be made.

In general, the United States wants to deal with immediate problems having foreseeable consequences and, so to speak, case by case, precedent by precedent, build a body of law. Such practical matters as agreements on the rescue of astronauts, the return of space vehicles, and liability for accidents involving space vehicles are, in the American view, the proper first steps in building space law.

The Soviet space lawyers, on the other hand, insist that it is necessary to establish a set of general principles and settle individual problems as they arise in the future. It happens that several of the general principles put forward by the Soviets would neatly enable them to attain terrestrial political objectives.

Obstacles to Accord

Limiting satellite ownership and responsibility to states, as the Soviets suggest, would prohibit the launching of future Telstars and banish free enterprise from space. The Soviet proposal that war propaganda be barred from space by international law raises the point that one man's war propaganda may be another man's factual news. A Soviet proposal that it be declared illegal to obtain information over another nation's sovereign territory not only opens up the difficult question of how high sovereignty goes but also seems aimed directly at reconnaissance satellites such as the United States' Samos system.

Obviously, with the two space powers at odds, it will be very difficult to develop the international space code much beyond the two general principles approved last December by the General Assembly: (i) that international law, including the U.N. charter, applies to outer space, and (ii) that outer space is free for exploration and not subject to national appropriation.

The cooperation agreement between the United States and the Soviet Union certainly does not mark a major détente in space on the part of the two countries. NASA appears to have played its cards very close to its space suit in dealing with the Russians, and no major American space project will depend on the agreement, nor will this country be making any important sacrifices in the matter of its space projects. The Soviets take a like position.

The past year, however, has witnessed real if limited progress in international space cooperation. If there has been less progress in space law, it is because the problems of strengthening international law are essentially the same in outer space and at sea level.

—JOHN R. WALSH

Announcements

Brooklyn Children's Museum announces formation of a **Junior Astronomical Society** and a **Junior Geological Society**, for students 12 to 17.

The Junior Astronomical Society plans classes in telescope-making, lectures and planetarium programs, and the use of the museum's refractor telescope.

The Junior Geological Society will have lecture sessions in various areas of geology, and will be able to use the museum's earth science laboratory to learn laboratory methods and to work on special projects.

Manuscripts, personal papers, photographs, references, or other material on the late **Matthew F. Maury** (1806–1873), founder of the U.S. Navy Oceanographic Office, are being sought for use in the preparation of his biography. (W. J. Cromie, 4000 Dunlavy, Houston 6, Tex.)

Meeting Notes

The 3rd international conference on **atmospheric and space electricity** will be held from 6 to 10 May at Montreux, Switzerland. Session topics include a survey on the present state of atmospheric and space electricity, general problems in atmospheric electricity, theories of charge generation in thunderstorms, the physics of lightning and its relation to other geophysical and physical phenomena, and space electricity. (S. C. Coroniti, Research and Advanced Development Division, Avco Corp., 201 Lowell St., Wilmington, Mass.)

Papers on three important scientific space experiments will be presented at the annual AAAS meeting under arrangements that have now been completed with NASA. The papers, dealing with Mariner II, the Alouette Topside Sounder Satellite, and the Orbiting Solar Observatory, will be included in a symposium of Recent Results in Space Research, starting at 2 P.M., 26 Dec., in the Grand Ballroom of the Sheraton Hotel, Philadelphia.

A technical symposium on **streamflow regulation** for quality control, sponsored by branches of the U.S. Public Health Service's Division of Water Supply and Pollution Control, will be held in Cincinnati from 3 to 5 April. Emphasis will be placed on the quality changes taking place within impoundments and in downstream reaches, including changes resulting from the method of release. (John E. McLean, Field Operations Section, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Pkwy., Cincinnati 26, Ohio)

An international symposium on the use and application of **radioisotopes and radiation in plant and animal insect control**, jointly sponsored by the International Atomic Energy Agency and the U.N. Food and Agriculture Organization, will be held from 22 to 26 April in Athens, Greece. The program will include discussions on the use of radioisotopes in insect ecology; labeling, application, mode of action, and fate of insecticides; the determination of residues in plants and animals; and the effect of radiation on insects and related arthropods. Deadlines: abstracts (maximum 350 words, 5 copies, in English, French, Russian, or Spanish), *1 February*; completed papers (maximum 5000 words, 5 copies), *8 March*. (J. H. Kane, International Conferences Branch, Division of Special Projects, U.S. Atomic Energy Commission, Washington, D.C.)

Grants, Fellowships, and Awards

Predoctoral traineeships in **radiation biology**, which permit recipients to devote full time to graduate training, are available at the University of Tennessee. Stipends are $2200 plus tuition and dependency allowances. (J. Gordon Carlson, Institute of Radiation Biology, University of Tennessee, Knoxville)