

F. A. S. NEWSLETTER

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----- to provide information and to stimulate discussion. Not to be attributed as official FAS policy unless specifically so indicated.

TREATY BANNING SPACE WEAPONS AGREED UPON AT U.N.

A treaty to assure that outer space will be used solely for peaceful purposes has been agreed upon by the United States, the Soviet Union and other members of the United Nations.

This was announced on December 8, 1966 by President Johnson at his Texas White House. Mr. Johnson called it "the most important arms control development since the limited test ban treaty of 1963" and an agreement of "historical significance for the new age of space exploration."

The treaty, as the President noted, is a more explicit version of the 1963 U.N. "no bombs in orbit" resolution. It will be submitted to the Senate for ratification soon after the new Congress convenes in January. The treaty has been under negotiation in the 28-nation U.N. Outer Space Committee but the talks have been principally between the United States and the Soviet Union.

Achievement of the agreement despite the damaging effect of the Vietnam war on Soviet-American relations is being widely viewed as indicative of a desire by the two superpowers to limit the effects of the war on their relationship.

In Moscow, the Soviet news agency Tass reported the agreement by quoting the President's announcement. In Paris, French officials welcomed the treaty as a sign of East-West rapprochement. British sources also warmly welcomed the document.

There has been no sign of any Senate opposition to the treaty; hence ratification is unlikely to produce the lengthy hearings and bitter opposition which President Kennedy faced on the test ban treaty.

The outer space treaty does not affect the use of intercontinental ballistic missiles which fly through space since they are surface-to-surface weapons. Nor will it affect the U.S. Air Force's manned orbiting laboratory (MOL). The Pentagon has taken the position that orbiting weapons in space would be far less effective as a military deterrent than are ICBMs; the Russians apparently have reached the same conclusion.

Also not affected will be reconnaissance satellites which both the U.S. and the U.S.S.R. use to photograph each other's territory and other parts of the world.

The chief effect of the new treaty is likely to be psychological; that is, to at least limit the area of potential nuclear warfare to the earth and to demonstrate Soviet-American willingness to cooperate despite Vietnam.

Soviet-American agreement was reached after the Russians modified an earlier demand for a "most favored nation" clause giving equal access to tracking station facilities in third countries.

The attitude of Albania, China's ally in the U.N. and a member of the U.N. committee, was unclear. France and China refused to sign the test ban treaty but France is expected to sign this one.

The key provisions of the draft treaty are:

- No nation shall "place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction" or install such weapons on the moon or other celestial bodies.

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UNDERGROUND NUCLEAR TESTS: MORE OF THEM AND MORE CONFUSION ABOUT DETECTION

Following are brief excerpts from an article by John W. Finney in the New York Times of December 21st (datelined Dec. 20th). After that, with sources indicated, are recent press reports on the nuclear test detection situation.

"The United States and the Soviet Union entered a new and comprehensive phase of atomic testing today as the United States set off an underground blast in Nevada designed to develop a warhead for an anti-missile missile.

"Both sides have detonated nuclear explosions that were probably larger than any underground blasts set off before.

"On Oct. 27, on the arctic island of Novaya Zemlya, near Murmansk, the Soviet Union conducted an explosion estimated, on the basis of seismic readings, to have had a yield of about one megaton—the equivalent of a million tons of TNT.

"Today, at the atomic proving grounds in Nevada, the Atomic Energy Commission set off a thermonuclear explosion nearly as powerful. Just how powerful the explosion was the A. E. C. would not say, except to observe that it was 'one of the largest' underground nuclear explosions ever conducted by the United States.

"The suspicion among United States experts is that the Soviet explosion had the same objective as that of the one in Nevada today.

"It is this accelerating race to develop a missile defense system that more than any other technical factor has set off the new round in atomic testing that was thought to have been placed under severe restraints by the limited test ban treaty of 1963. . . .

"As they have developed a technological sophistication in underground testing . . . both sides have been able to get around many of the apparent restraints of the test ban treaty. By drilling deeper, they have been able to conduct larger tests that still kept the radioactivity contained. Through various instruments implanted in the underground test chambers, they have been able to acquire much of the diagnostic information on weapons design and effects that once could be obtained only through atmospheric tests.

"Ever since the test ban treaty was signed in August, 1963, both sides have been steadily increasing the size and number of their underground tests. The United States conducted 12 underground weapons tests in 1963. There were 21 in 1964, 25 in 1965 and 34 this year.

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FAS COUNCIL TO MEET . . .

The next FAS Council Meeting will be held on January 29 and 30, 1967 in the Clinton Suite of York Hilton Hotel, located near Rockefeller Center of the Avenue of the Americas at 53rd Street, New York City.

The meetings will begin at 7 P.M. on Sunday night, January 29 and at 8 P.M. on Monday night, January 30.

Among other items on the agenda is further consideration of whether the FAS should issue a position paper or statement on the Vietnam situation.

UNDERGROUND NUCLEAR TESTS

(Continued from Page 1, Col. 2)

"There has been a comparable increase on the Soviet side, according to officials. . . .

"Many of the United States tests have been related to the problem of a missile defense system, either in developing warheads for an anti-missile missile or offensive warheads that could penetrate an enemy defense. It is presumed that the Soviet tests have had the same primary objective. . . .

"Within disarmament circles . . . there is rising concern over the impact the testing race, set off by the quest for an anti-missile missile, may have upon a whole range of proposed arms control measures.

"Even if the differences over inspection requirements could be resolved, it is feared that both sides would be unwilling to enter into a comprehensive test ban including underground tests. Similarly, it is believed that both sides might be losing interest in a 'threshold' treaty, banning easily detectable tests, since this would preclude the larger tests necessary for missile defense warheads.

"Hopes are also dwindling for agreement on a proposed cutoff in the production of fissionable materials. With its hundreds of warheads, a missile defense system would require large new amounts of fissionable materials, particularly plutonium, and presumably neither side would be willing to foreclose the possibility of developing such a system by entering into a cutoff arrangement.

"There are also growing fears that the testing might jeopardize acceptance of an atomic nonproliferation treaty, which at this point seems the most promising arms control step.

Some of the non-nuclear states are already raising the objection that a nonproliferation treaty, while prohibiting them from developing atomic weapons, would in no way prevent the nuclear powers from improving and expanding their atomic arsenals.

"This objection of discrimination, it is feared, is likely to gain added force as the non-nuclear states watch the two major nuclear powers intensify their testing of atomic weapons."

An optimistic report on nuclear test detection appeared on December 22nd (AP story). According to "Pentagon officials" the U.S. has greatly increased its ability to detect, identify, and locate underground nuclear tests inside Russia. There were suggestions that the U.S. might modify its demands for on-site inspection and renew negotiations toward banning underground tests.

But pessimistic results on nuclear test detection capabilities appear to have emerged from a test conducted (New York Times, Washington Post; 4 Dec. 1966) in Mississippi on Dec. 3rd. This test, labeled "Sterling," involved the explosive power of 350 tons of TNT and was the first major trial of the theory of "decoupling" or muffling of nuclear tests. According to Representative Craig Hosmer, Republican of California and ranking Republican on the Joint Congressional Committee on Atomic Energy, the test "definitely demonstrated" the possibility of muffling an explosion by setting it off in a large hole. Hosmer is presumed to have advanced information on the Sterling results because of his JCAE position. The decoupling factor was said by "Pentagon sources" to be about 100 (John W. Finney in the New York Times; 30 Dec. 1966).

WESTON, ILLINOIS, GETS THE 200-BEV MACHINE

(By the time this Newsletter is delivered, the above headline is hardly news to any scientist, at least any physicist. But a few facts may be of interest anyway. See AEC release of Dec. 16, and the New York Times and Washington Post of Dec. 17—H.L.P.)

In the final competition, Weston won out over Ann Arbor, Mich.; Upton, Long Island, New York (Brookhaven); Denver, Colo.; Madison, Wis.; and Sierra Foothills, Cal. (near Sacramento). The overall accelerator installation will cost about \$400 million and annual operating costs will be in the \$60 million neighborhood. It will employ about 2,000 people, and occupy a 6,800 acre tract. The site is about 15 miles from the Argonne National Lab and from O'Hare Airport, and about 30 miles from the University of Chicago.

Although the AEC says that construction of the accelerator will be completed in eight years, it is not exactly clear that the project will move ahead at full speed. One possibility for saving money is to build a stripped-down version with 200-Bev energy but a beam current lower than originally planned. Initially the AEC is expected to ask for only \$10 million to continue design work.

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The FAS, founded in 1946, is a national organization of scientists and engineers concerned with the impact of science on national and world affairs.

Sources of information (given in the articles in parentheses) are for further reference. Items reprinted directly from other publications are designated as such in an introductory paragraph.

SPACE TREATY

(Continued from Page 1, Column 1)

- Military bases and fortifications, testing of weapons and conducting military maneuvers are forbidden on celestial bodies. But military personnel may be used for peaceful pursuits.

- "There shall be freedom of exploration and use of outer space" for all nations and none may claim sovereignty. To verify peaceful uses, there shall be open access to moon stations subject to "reasonable advance notice" to ensure safety precautions.

- Every nation has "an unconditional obligation to help and to return astronauts" if they land elsewhere than planned. Launching states are liable for damages caused by their space vehicles.

- Arrangements for tracking stations will be reached bilaterally between nations with such requests "considered on the basis of equality."

- The exploration and use of outer space "shall be for the benefit of all mankind." Man's activities in space are subject to international law. The moon and other celestial bodies "shall be used exclusively for peaceful purposes."

- All states should avoid harmful contamination of celestial bodies or adverse changes in the earth's environment due to space activities.

(Washington Post, New York Times; 9 Dec. 1966)

Later, on Dec. 17, 28 delegations spoke in the U.N. Political Committee in favor of the treaty which was approved and forwarded to the General Assembly, where overwhelming approval is expected. Also, on Dec. 16, the Political Committee unanimously approved a resolution in favor of an international conference in Vienna next September on the peaceful uses of outer space. (Washington Post; 18 Dec. 1966)

NEWS ITEMS

On November 16, a group of U.N. representatives inspected a shut-down plutonium producing reactor at Hanford, Washington. To encourage support for verifiable disarmament agreements, the U.S. last summer invited all members of the U.N. General Assembly to visit such a production reactor. Fifty nations accepted, but no Communist nations were among them. Also shown was a technique using "safing tapes"—in effect, reactor "seals" that require only an occasional check to verify that they have not been broken—which could be used to simplify the inspection of shut-down reactors. (New York Times; 17 Nov. 1966)

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Some reports from Russia indicate increased concern with civil defense preparations against possible nuclear attack. There have been published calls for CD training for citizens and for more shelters and protective equipment. There is speculation that, although possible attacks by "imperialists" are mentioned, China—an increasingly unfriendly neighboring power with a growing nuclear capability—may be on Soviet minds. (New York Times; 23 Nov. 1966)

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Declaring that he sees no urgency as to who lands on the moon first, Senator Clinton P. Anderson has called for co-operation among countries in the exploration of space. "I think every time we've tried to race we probably waste some money," the New Mexico Democrat, who is chairman of the Senate Aeronautical and Space Sciences Committee, said in an interview. He discounted the theory that a lunar landing would have military significance and said that had the United States and the Soviet Union cooperated from the start in space exploration, more knowledge at less expense might have resulted. He warned that Congress, faced with costs of the Vietnam war and numerous domestic programs, might go slowly on space programs after the country's landing on the moon by Apollo astronauts was accomplished. (New York Times; 15 Dec. 1966)

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The Soviet Union will build two new nuclear reactors in the Ukraine, each for the dual purpose of generating electricity and desalting sea water, the press agency Tass announced. The agency said a canal 58 miles long would be built from the Sea of Azov to pump salt water to the new nuclear plants in the Donets Basin, an industrial area of the Ukraine. The idea is to supply both a new source of electric power for industry and a new source of fresh water.

The Russians are building an atomic reactor in western Kazakhstan at Shevchenko, on the coast of the Caspian sea, where a new oil field is under development. The reactor is supposed to be ready by 1969. The cost of desalting water at this plant is expected to be about \$1 per 1,000 gallons of water.

The United States is building a \$434.7-million atomic-powered installation south of Los Angeles to go into operation by 1971. This plant is supposed to be capable of desalting 150 million gallons of water a day, enough for a city the size of San Francisco. The cost at the American plant is expected to be 20 or 30 cents per 1,000 gallons of water, a competitive rate. (New York Times; 11 Dec. 1966)

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A Public Health Service reorganization plan now going into effect is intended to broaden the role of the PHS in bringing to the public various benefits of research and various health services. The plan, which establishes five operating bureaus, apparently stems from (1) President Johnson's order to HEW Secretary Gardner to make the fruits of research more directly available to the public, and (2) the need to implement new health services authorized by the 89th Congress. William D. Carey, Assistant Budget Director of HEW, said recently, in regard to PHS research:

"As I look ahead, the scene will be one of transition. In the main, the Government will continue to support undirected research strongly, but it will also be looking for opportunities to invest more substantially in what may be called 'directed'

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WAS MEETING ON FEDERAL SUPPORT OF RESEARCH

As noted in the November Newsletter, meetings of the Washington Association of Scientists are focussing on trends in federal support of scientific research. Principal participants in the November WAS meeting were David Robinson and Raymond Bowers from the President's Office of Science and Technology. Following are some points from the discussion.

There are at least two major discernible recent trends in federal support of science. One is a broadening of policy aims, from support of research projects to promoting general progress of academic institutions, which would provide both research and training. Second is a leveling off of the rate of increase in funds to support scientific research.

Currently, federal funds going into universities for science research are about \$1.4 billion a year. This includes research money available from AEC, DOD, NASA, NIH, NSF, and the Office of Economic Opportunity. In the "post-Sputnik" years 1958-1963, such federal spending had risen about 25% each year; the increase in fiscal 1964 was 15% and in fiscal 1966 10%. Another trend, in the past 10 to 15 years, has been a much greater percentage increase in funds from NASA and NIH and a smaller percentage increase (though absolute amounts rose) from DOD and to a lesser extent AEC. This trend implies more emphasis on biological and less on physical sciences, though other factors affect the division.

The main recent development, however, has been much higher federal spending for a much broader range of support to colleges and universities, for buildings, training programs, and fellowships. This now stands at about \$4 billion a year total, including the \$1.4 billion for science research. Support for higher education in general has meant that more money goes to a larger number of institutions, broader geographical distribution, more emphasis on social sciences, and more general fellowships (about 25,000 a year). For science, there has been less emphasis on research projects and results. (But "general" funds often support science research: a fellowship might replace a research contract job, and funds for a science building tend to generate university and outside financing of research programs.)

These trends in federal budgeting lead to some interesting questions: One major question stems from the evident trend to emphasize postdoctoral research; in recent years, this has taken about 25-30% of federal science research funds, via contracts more than fellowships. But there is speculation that fewer postdoctoral positions will be available to meet a rising demand for them. Another trend thought likely is some increase in funds universities would allocate to research, currently about \$74 million a year. It seems possible, but less probable, that there would be a decline in the number of science students or in teachers doing research. There have been general predictions that the U.S. will soon be producing more Ph.D.'s (in science and other fields) than are "in demand," which may lead to "low level" use of their training.

But problems and changes arising from these developments in science may be met by a process of "self-adjustment" and new policies in Government, universities, and elsewhere. There is still reason to think that the demands of a technological society will require increasing numbers of highly trained scientists—though not necessarily for university jobs or "basic" research.

NEWS ITEMS

(Continued from Page 3)

research, which means the deliberate, systematic and programmed effort to seek a well-defined research or development objective—possibly through contract rather than grant mechanisms.” (Washington Post; 11 Dec. 1966)

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The Atomic Energy Commission has made available for public use so far a total of 3,762 patents (or patent applications) owned by the Government and held by the AEC. (AEC Release; 25 Nov. 1966)

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Tougher sledding for science legislation in the next Congress is expected by many Washington observers in the wake of the November elections. While such key science committee chairmen as Rep. Holifield (D.-Calif.), Rep. Daddario (D.-Conn.) and Rep. Reuss (D.-Wis.) kept their seats, several strong supporters of expanded federal aid to education and research were defeated including Sen. Douglas (D.-Ill.), Rep. Schmidhauser (D.-Iowa) and Rep. Todd (D.-Mich.). Observers point out that both parties in Congress as well as the administration will reflect the trend of the election pointing to a slowdown in “Great Society” programs. (Physics Today, Dec. 1966)

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The fifth Chinese nuclear test occurred on Dec. 28th. The AEC reported the yield as a few hundred kilotons. The first two Chinese tests, in October 1964 and May 1965, apparently involved relatively low-yield enriched uranium devices. The third test, last May 8th, is reported to have involved some lithium-6, a thermonuclear material. The fourth test on October 26th used a missile to carry the device before explosion. There is speculation, based partly on the accelerating rate of testing, that China may already have a small number of nuclear weapons deliverable over short distances by various means. (Three articles in the New York Times; 29 Dec. 1966)

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Defective management of federal research laboratories has been charged by the House Research and Technical Programs Subcommittee, headed by Henry S. Reuss (D.-Wis.). Based on a case study of in-house federal pollution research conducted by the Library of Congress, the subcommittee concluded that the federal government, though it spends \$4

billion annually on R&D in its own laboratories, “does not know exactly how many laboratories it has, where they are, what kinds of people work in them or what they are doing . . . Complete information on projects being undertaken by federal laboratories and cost of those projects is not available.” (Physics Today; December 1966)

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One measure of the extent of congressional participation in decisions on federal support of research and development is to be found in a newly issued bibliography titled “An Inventory of Congressional Concern with Research and Development.” Prepared by the Library of Congress for the subcommittee on government research of the Senate Government Operations Committee, the study, covering the last two Congresses, runs to 120 pages. According to the foreword, it lists all congressional documents that touch upon any part of the federal government’s multi-billion-dollar expenditures for research and development. Copies may be obtained without charge by writing to the subcommittee, Room 217A, Old Senate Office Building, U.S. Senate, Washington, D.C. (Science; 23 Dec. 1966)

EDITOR’S NOTES —

Through a proofreading slip, the first News Item in the November Newsletter referred to the “South Chinese nuclear test” instead of “fourth Chinese nuclear test.” It should be made clear that the Newsletter is not trying to influence the question of whether there should be one or two Chinas in the U.N. by inventing a third one.

It has come to my attention that the statement, made in the September Newsletter and mentioned in the November Newsletter, that the University of Pennsylvania has discontinued secret government-sponsored research is not correct as it stands. Recent developments relating to secret research at Pennsylvania will be clarified in the January or February Newsletter.

The Christmas holidays and other circumstances have delayed this issue of the Newsletter (and also necessitated carrying over some items to the January issue). I hope normally to be able to get Newsletters in the mail early in the month for which they are dated.

—H.L.P.

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