

# 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.

## FAS ELECTION RESULTS

The following list of FAS officers and Council members includes those most recently elected. An account of the last Council meeting will appear in the next issue.

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Air Force Cambridge Research Center, Bedford Mass.
- Treasurer—Dr. Jack Orloff  
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National Institutes of Health, Bethesda, Md.

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Institute for Advanced Study, Princeton, N. J.
- Professor Allen Janis  
Department of Physics, University of Pittsburgh,  
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- Professor John S. Toll  
University of Maryland, College Park, Md.

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Dr. Arthur H. Rosenfeld, Berkeley, Calif.  
Matthew Sands, Pasadena, Calif.  
Dr. John S. Toll, College Park, Md.

### Delegates-at-Large (2-year term expires 1965)

- Mrs. Ruth Adams, Chicago, Ill.  
Dr. Peter Axel, Seine-et-Oise, France  
Dr. Donald G. Brennan, Harmon-on-Hudson, N. Y.  
Dr. Freeman J. Dyson, Princeton, N. Y.  
Dr. Gary Felsenfeld, Washington, D. C.  
Dr. W. A. Higinbotham, Upton, L. I., N. Y.  
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Dr. Robert Williams, Seattle, Wash.  
Dr. Hugh C. Wolfe, New York, N. Y.  
Dr. Lincoln Wolfenstein, Pittsburgh, Pa.

## RADIO ASTRONOMY

### “INTERFERENCE” PROBLEMS

On May 6th, the Air Force again stirred up the “needle controversy” with an announcement that “in the near future” an attempt would be made to orbit a belt of copper needles. On May 12th, the Lincoln Laboratory of MIT announced that its field stations in Westford, Mass. and Pleasanton, Calif. had made radar contact with the cloud of filaments. Apparently the needles had been ejected successfully this time from an Air Force satellite in orbit. The cloud of needle dipoles is in a near-polar orbit, about 2000 miles high, with a period of 166 minutes. It is expected that the needles will spread out slowly along the orbital path and, in a few months, form a complete narrow ring about the earth. The average spacing between filaments should be approximately one quarter of a mile.

The first (unsuccessful) attempt to perform this experiment in October 1961 had touched off a round of criticism and controversy, principally from astronomers here and abroad who feared that the belt of needles might seriously interfere with radio astronomy observations. Criticism also was expressed over the right of any nation to purposefully change or affect unilaterally the properties of space about the earth. The issue subsequently was taken up by the President's Science Advisory Committee which concluded that the experiment could be conducted “without danger to science.” The Lincoln Laboratory (conducting the experiment for the Air Force) also has stated in a “fact sheet” released with the May 6th announcement that “careful advance study indicates that the possible interference of the experimental

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## FAS URGES PROTECTION OF TV CHANNEL FOR RADIO ASTRONOMY

The following comments were submitted to the Federal Communications Commission on May 1, pursuant to the instructions of the FAS Council at the Washington meeting, April 23. (See news report elsewhere in this issue.)

Although the proposed rule making in FCC Docket 15022 is limited to considerations affecting only one observatory, the Vermillion River Observatory of the University of Illinois, the broader question of obtaining an adequate band for radio astronomy in the UHF region of the spectrum is so intimately connected that it is appropriate to address the larger question. Channel 37 (609-614 Mc/s) has been agreed upon internationally as a suitable choice of a cleared band for radio astronomy, and in Europe steps have been taken to protect this band for radio astronomy. In the United States, however, adoption of the proposed rules in Docket

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## A LETTER ON THE TEST BAN

The following letter is reprinted from the Washington Post of April 9:

In view of recent controversy concerning the desirability of concluding a nuclear test-ban treaty with the Soviet Union, we wish to make the following statement in support of the efforts of the United States Government to conclude such a treaty as soon as it can be negotiated.

Our primary reason for support lies in the fact that a test-ban treaty is in the best interests of the United States and of world peace. A treaty would reduce the speed of the present arms race, inhibit the spread of nuclear weapons to nonnuclear powers, reduce the likelihood of nuclear war, and prevent the extension of the hazards of fallout. We therefore commend the President of the United States for his sincere attempt to reach a workable agreement with the Soviet Union on a test ban, and urge that members of the United States Congress and of the general public consider the question of the test-ban treaty in the light of scientific fact and rational argument rather than in terms of partisan politics.

Unfortunately, public debate on the issue has been confused in recent weeks by some members of Congress and by public figures who have attacked the test-ban treaty by spreading a completely false view of the test-ban situation. They also would appear to be operating on the fallacious assumption that American security can best be maintained by unlimited development of our nuclear weapons capability no matter what the other nations may be free to do in this regard. The attackers have failed to recognize the clear fact that once the overkill capabilities of the Soviet Union and the United States have reached their present level—and hardened missile bases are in place, making a successful disarming attack impossible for either side—an increase in nuclear capacity by one side or the other does not upset the balance of deterrence.

### DETERRENCE REMAINS

Even though we probably possess between three to eight times as much intercontinental nuclear weapons capability as the Soviet Union, we would still have little chance of escaping an incredibly destructive retaliation were we to strike first with our strategic force. Since the smaller Soviet force is enough to deter us from a nuclear attack on the Soviets, a considerable change in force levels would still leave us with more than sufficient force to deter the Soviets from making a nuclear attack on us.

The opponents of the test-ban treaty also base their argument on the fallacious assumption that any attempt on our part to negotiate with the Soviet Union means that we are taking a soft political line and making dangerous concessions. The treaty opponents therefore consider any lowering of the number of on-site inspections by the United States simply as a sign of weakness and of yielding to the advantage of the Soviet Union, rather than as realistic negotiation to improve national security. In fact, during the period since the test-ban discussions began in 1958, detection techniques have been rapidly improving and may be expected to improve still further. It is now possible to detect many of the explosions within a given country by stations outside that country, and the number of on-site inspections required for checking the identification of earthquakes versus explosions has been greatly reduced. Research has also shown that there are many fewer earthquakes in the Soviet Union than was formerly thought, thus making a reduction in the possibility of their being confused with nuclear tests.

The strategy of the opponents of a treaty is to exaggerate the risks of clandestine testing and to minimize the risks of a continuing nuclear arms race. Among the most flagrant violations of fact which they have publicized in these matters are the recent statements by Dr. Edward Teller that a test-ban agreement "would be virtually unpoliced" and "would not interfere with Russian progress," and Senator Dodd's claim that the test-ban policy of the Eisenhower and Kennedy Administrations "has already cost us our nuclear superiority over the Soviets."

### MISSTATEMENT CHARGED

In making this claim, Senator Dodd is completely misstating the facts as set forth by responsible Department of Defense officials. If the Soviets learned more than we did in the 1961-62 testing and narrowed the gap between us, it was because they had more to learn. There is every reason to

believe that they would have narrowed the gap even more rapidly had there not been a moratorium and had there been continuous testing on both sides after 1958. Conversely, if we had been able to conclude a test-ban treaty in 1959, the Russian tests of 1961-62 would not have taken place and we would still have our great superiority of nuclear weapons technology. By no stretch of the imagination could these tests have been carried out secretly underground.

The direct advantages to the United States of a test-ban treaty are these:

1. Dependable assurance that no atmospheric testing, which is the really important kind, is taking place.
2. Reasonable assurance that underground testing of small nuclear weapons is not taking place.

What assurance do we have that in the event of a test-ban treaty the Soviet Union would not conduct secret underground tests?

Even though a single small test might be concealed by being confused with an earthquake if the test were conducted in a region of frequent earthquake occurrences, any significant series of tests would be almost impossible to conceal.

### RISK IS EMPHASIZED

It is extremely unlikely that the Soviet Union would be willing to risk the breakdown of the treaty for the marginal gain they might achieve by testing explosions small enough to escape detection. It is important to recall that American nuclear weapons experts insisted that underground testing was of little value for military purposes when, in 1961, our testing was temporarily limited to underground explosions. We have additional assurance in the fact that the Soviet Union has agreed to three on-site inspections should suspicious indications of underground testing be discovered by the detection system of the United States and the United Kingdom, and is willing to permit a number of automatic seismic stations on Soviet territory.

The Soviets surprised us by starting big atmospheric tests in 1961 when we thought at that time they would continue negotiations for a test-ban treaty. The opponents of a present treaty now claim that this means the Soviets broke a test-ban agreement in 1961. On this basis they warn against entering another agreement. It is too often forgotten that there was no test-ban agreement (much less a treaty) in 1961; and that President Eisenhower on Dec. 29, 1959, terminated the one-year informal moratorium by announcing, "The voluntary moratorium on testing will expire on Dec. 31." Even though the Soviets and most other nations have broken treaties, a test-ban treaty would be very different from a mere cessation of tests, particularly if adhered to by an increasing number of nations, because it would be in the interest of the United States and the Soviet Union to abide by it. To be on the safe side, our developments and preparations would continue as far as possible without testing, and there should be no doubt that American testing would be resumed if the Soviets should break the treaty by again resuming tests in the atmosphere.

Even if the treaty should be abrogated after a time or should fail to develop into a world test ban because of the recalcitrance of France or China, it would not have interfered with our nuclear development appreciably more than the Soviet's. The treaty would emphasize above all the common interest of the United States and the Soviet Union in trying to avoid nuclear war.

In summary, the test-ban treaty, as proposed, will stop atmospheric testing as long as the treaty is in effect. It will leave some uncertainty about very small tests (one ten-thousandth the size of the H-bomb) but could reasonably be expected to deter the Soviets from even small-scale cheating (a) because it would teach them relatively little, (b) because of the serious risk of being caught and (c) because there are good reasons for the Soviets to want the treaty to function.

Careful studies by the foremost experts in the United States and by the President's advisers on national security, including those in the Defense Department, have furnished the conclusion that the risk of continuing the arms race without a test-ban treaty is considerably more than the risk that such a treaty might be violated by secret testing. We support the President in this conclusion and believe that once the members of Congress and the people of the United States are aware of the realities of our present situation and of the facts of the test-ban case, that they too will support the

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## TEST BAN

Throughout March and April, the clouds steadily thickened over the test ban outlook: the domestic debate on U. S. test policy seemed to grow, while the debate with Russia got nowhere and even the neutrals at the Geneva disarmament talks suspended their efforts to mediate. The Soviet Union repeatedly demanded immediate acceptance of its new offer to allow two or three annual inspections, charged the U. S. with bad faith in seeking a quota of seven, and rejected Western efforts to defer "the numbers game" pending agreement on other crucial details of the system to cover unidentified seismic events. (See March Newsletter.)

During April, the U. S. agreed to a British proposal that the two allies' Ambassadors seek an interview with Premier Khrushchev, to sound out Soviet policy on the test ban, disarmament, and other problems. Just before this meeting, Premier Khrushchev used an interview with an Italian newspaper editor as the springboard for a lengthy critique of Western arms policies. He stressed that the U. S. and U. K. were blocking a test ban agreement, and warned that the Soviet Union was considering whether to withdraw its readiness to accept three inspections. (Excerpts in N. Y. Times, 4/22.)

On April 24, the Ambassadors met with Khrushchev and presented a Kennedy-MacMillan letter urging new action on the test ban problem. On hearing first reports that Khrushchev's attitude was negative, President Kennedy warned that "time is running out." Further gloom spread over the Geneva talks, where the Soviet representative echoed Khrushchev's attacks and called the conference a "waste of time." (N. Y. Times, 4/25 & 4/30.)

At his next news conference, the President gave a bleak forecast concerning a test ban treaty: "If we don't get it now, I would think perhaps the genie is out of the bottle and we'll never get it back in again." (N. Y. Times, 5/9.)

The next chapter was a rash of contradictory reports concerning AEC-Defense plans to hold several small nuclear tests, including one above ground, at Nevada later in May. The proposed tests were cancelled on May 13, apparently to avoid adding any new complications to the test ban seesaw. Meanwhile, also on May 13, the White House received Khrushchev's formal response to the Kennedy-MacMillan overture: press reports said the letter neither slammed the door on negotiations nor opened it wider.

Reacting to the growing pessimism, the *New York Times* of May 15 made the following editorial comment:

### "SAVING THE TEST-BAN TALKS

"In another move to save the five-year-old nuclear test ban talks from collapse and avert another East-West testing race, the United States has now canceled the three minor tests it had scheduled for later this month. This is a wise and welcome decision.

"In fact, considering President Kennedy's determined efforts to reach a test-ban agreement, the scheduling of the tests in the first place poses a mystery. It may be explicable as a compromise in the infighting now going on in Washington between the proponents and opponents of new tests. For the beneficial scientific value of the tests could be only minimal; but their adverse political and psychological effect was bound to be great.

"As might have been foreseen, the U.S.S.R. promptly pounced on the tests to accuse the United States of starting a new round in the nuclear arms race. The Soviets threatened to retaliate with a massive test series of their own, which they are suspected of already preparing. The cancellation of our tests deprives them of any propagandistic pretext for resuming theirs.

"But cancellation is not enough. Even more determined efforts are necessary to break the present deadlock. President Kennedy has found new and powerful support in such an effort from 27 distinguished scientists, including three Nobel laureates. They have issued an appeal to Congress and the public to back a test-ban treaty as being in the best interests of the United States and of world peace. They urge, as does this newspaper, that the risk of continuing the arms race without a test-ban treaty is considerably greater than the risk that a ban might be violated by secret testing. For such a treaty would stop immediately all above-ground tests; and though some uncertainty might remain regarding underground tests, these have been found of lesser military value. Detection techniques are already such as to make it too risky for the Soviets to cheat. The treaty might

## STRONTIUM 90 IN TEETH

Radioactive strontium in the teeth of St. Louis children increased sharply between 1954 and 1955, during a period of intensive nuclear testing, it was reported in the April 12 issue of *Science*.

The report was written by Professor Harold L. Rosenthal, Dr. John E. Gilster and Dr. John T. Bird, of the Washington School of Dentistry, where a special laboratory has been set up under a grant from the U. S. Public Health Service to study the teeth collected by the St. Louis Citizens' Committee for Nuclear Information's Baby Tooth Survey.

Reporting on an analysis of incisors shed by children born in the years 1949 through 1957, Professor Rosenthal and his colleagues note that after the sharp increase in 1954-1955, the strontium 90 content of the baby teeth continued to increase in 1956 and 1957, but at a slower rate. Somewhat less strontium 90 was found in the teeth of children who were breast fed than in those who were bottle fed.

The radioactive content of the baby teeth, the *Science* paper says, rose from 0.18 strontium units in 1949 to 2.56 in 1957. (Strontium units measure the amount of strontium 90 present per gram of calcium.) These are average amounts for the teeth of children born in those years.

### A LETTER ON THE TEST BAN

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President in his effort to find answers to the greatest question before the world today—the question of survival.

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Chairman.....Robert R. Wilson

The FAS Newsletter is prepared in Washington by FAS members. The staff for this issue were: Editor—Gary Felsenfeld; Writers: L. Gellert, N. Seeman.

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

not last, but as long as it lasts, it would leave our nuclear deterrent capacity intact, reduce the speed of the armament race, help to inhibit the spread of nuclear arms, reduce the likelihood of nuclear war and prevent further lethal fallout.

"Other scientists, of course, and most military men disagree, including the Joint Chiefs of Staff. They argue that further tests are necessary to perfect our defensive weapons, in particular an anti-missile missile in which a Russian breakthrough could neutralize our whole nuclear arsenal. Also the Russians must still clarify the methods of the three inspections they are ready to admit. Many issues are still to be resolved; but the stakes are too high for either side to let the talks end in failure."

## RADIO ASTRONOMY—"INTERFERENCE PROBLEMS"

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dipole fibers in orbit to spacecraft, optical and radio astronomy investigations and to other radio and radar systems is negligible." Also emphasized was the feature that "no other communication method suggested to date, by satellite or otherwise, offers comparable reliability in terms of global coverage with virtually complete invulnerability to destruction or jamming." The belt is expected to have a lifetime of about five years, with radiation pressure from sunlight forcing the filaments down into denser atmosphere where they will burn up.

With two such belts, one circling east-west and the other north-south, communications could hopefully be maintained between any two points on earth in no more than two hops. (N. Y. Times 5/7, 5/12; Wash. Post 5/13)

Radio astronomers are embroiled also in another controversy involving the Federal Communications Commission and the application of a private group to operate a TV station on UHF Channel 37. This channel would operate in the same frequency band (608-614 megacycles) that the International Telecommunications Union has recommended be left free for astronomical observations. The University of Illinois already has installed a huge radio telescope at Danville, Ill. designed to operate in this frequency band. An application to the F.C.C. for a television station has now been made to operate on Channel 37 in Paterson, N. J. Thus far, the F.C.C. has been able to shift UHF television assignments to avoid the use of this channel. However, in the Paterson case, the geographic and band separation requirements set up by the F.C.C. leave no UHF channel available but Channel 37. For New Jersey this application represents an opportunity to have its only commercial television station.

The University of Illinois scientists, supported by a committee of the National Academy of Sciences, have protested to the F.C.C. pointing out that signals from Channel 37 TV stations could interfere with the reception of the normally very weak signals studied by the radio astronomers.

At present the F.C.C. has attempted a compromise by issuing regulations to protect the Danville observatory. For the next five years no Channel 37 station would be permitted within 600 miles of Danville (Paterson, N. J. is about 700 miles away). Also for the next five years, no Channel 37 station anywhere (in the U. S.) would be permitted to operate between midnight and 7 a.m., thus giving the observatory several hours of "free" reception every night.

The basic issue remains unresolved. The I.T.U. recommendation (in 1959) has never been officially adopted in this country and the F.C.C. obviously has avoided the general problem of national allocation of frequencies to be reserved for astronomical studies.

The F.A.S. has submitted comments on this question to the Federal Communications Commission. The comments are printed elsewhere in this issue.

## FAS URGES PROTECTION OF TV CHANNEL

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15022 would certainly result in establishment of a broadcast station at Paterson, N. J. that would interfere with attempted observations at the majority of active radio astronomy observatories in the United States, including the National Radio Astronomy Observatory at Green Bank, W. Va.

The quiet hours proposed in Docket 15022 would so severely limit observing time that observing programs would probably be doubled or trebled in time. For example, the University of Illinois has stated that their five-year program would have to take ten to fifteen years if they experience troublesome interference when the station at Paterson, N. J. is broadcasting. The difficulties imposed on radio astronomers by nature are sufficiently severe without compounding the difficulties by additional man-made limitations, and such a constraint as this would probably deter a group from even starting such a project.

In the interest of science as a whole, and astronomy in particular, it is strongly urged that the Federal Communications Commission address itself directly to the problem of obtaining a world-wide clear channel for radio astronomy in the 600-800 Mc/s region of the spectrum, and that the proposed rule making of Docket 15022 be re-examined for more suitable solutions. It is surely not too much to expect that more positive measures could be taken to secure such a band in the region of the radio spectrum that is at present so free of broadcasting activity. We hope that, if a broadcast license in Channel 37 continues to be considered for allocation, a public hearing will be held by the FCC before the final decision, and that representatives of the appropriate scientific groups will be consulted. We note that strong opposition to any commercial utilization of Channel 37 has been expressed by the American Astronomical Society and the American Geophysical Union. We join with these groups and many of the institutions where radio astronomy research is being pursued in urging that the FCC try to strengthen the protection now granted to Channel 37 and other portions of the radio spectrum which are of particular interest for the observations of radio astronomers. We hope that stronger international agreements can be proposed by the United States which will allocate this band and corresponding bands appropriately spaced throughout the electromagnetic spectrum so that approximately 1/2 to 1% of the frequency spectrum within each factor of two of frequency can be left available for scientific research.

The commercial uses of the electromagnetic spectrum may soon fill 99% of the available channels, but it is particularly important that the Federal Government defend the long-term needs of science against the immediate pressures of commercialism.

Radio astronomy as a science began in the United States, and it would be indeed tragic if the United States should now lead the way in closing off these vital windows on the universe.

## FAS NEWSLETTER

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