

F. A. S. NEWSLETTER

Volume 17, No. 10

December, 1964

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

NUCLEAR EXCAVATION FOR CANAL POSSIBLE

A call for public hearings before a decision is made to use nuclear explosives in the excavation of a sea level canal was issued by the Committee for Nuclear Information following President Johnson's announcement that a sea level canal is to be built.

While the president's announcement said nothing about the use of nuclear explosives, this possibility has been much discussed and the last Congress appropriated five million dollars for a survey.

"If plans were for the use of conventional explosives," said the statement issued by Glenn Moller, CNI president, "it would seem likely that the conversion of the present canal into a sea-level canal would have been mentioned as one of the possibilities, since this would cost only about half as much as the cheapest new canal. Using nuclear methods would be far cheaper than either a new or converted canal dug by conventional methods."

A detailed report on "nuclear digging" has been prepared for CNI by Michael Friedlander, associate professor of physics at Washington University and appears in the current issue of the Committee's publication, *Scientist and Citizen*.

The report points out that "The advantage of nuclear methods, from the point of view of cost, is clear. Not so clear are the risks which may arise . . ."

According to this analysis, some fallout would result from the cratering explosions. Despite suggestions for moving several thousands of people from the vicinity of the canal site, some permanently and some temporarily, to avoid direct exposure to the fallout, the long range effects on the various kinds of life in the region are not known. There would be a certain amount of radioactivity deposited on the ground which would affect the vegetation. Studies of the effects of radiation on plants in the U.S. are not applicable, as those in Central America are different, so that special studies are needed. Also, radiation which might otherwise be trapped, might prove soluble when the ditch is flooded and could affect marine life.

Prof. Friedlander says the explosive power involved in the canal project might be as much as the total megatonnage of all nuclear bomb tests up to 1958.

Before any nuclear excavation takes place, the report states, ". . . the Atomic Energy Commission must be able to show to the satisfaction of the scientific community and the public that the biological risk is acceptably small. This means study and open publication of the results of bioenvironmental, geological, meteorological and engineering studies and their independent evaluation before the decision to carry out the project becomes final."

The report also refers to the Test Ban Treaty (*see JOINT PROJECT page 2*), which forbids nuclear explosions which deposit radioactivity on other countries. This provision has inhibited underground experimental explosions within the U.S. if the AEC was not able to guarantee that no radioactivity would be vented and drift across the border.

"According to the most recent available information, we are still a long way from having the technical problems of a nuclear-dug sea-level canal solved and the necessary number of explosives stockpiled," the CNI statement concluded.

(Com. for Nuclear Information,
News Release, 12/20/64.)

NEW DIRECTION IN DEFENSE TALKS

For the past six months, disarmament proposals seemed to be marking time, and the headline news was of defense policy, the U.S. pre-election debate, and the controversial proposal for a NATO multilateral force. Within about six weeks, the headlines have changed markedly: the U.S. and most other NATO countries are seeking harmony in the alliance and new approaches to the MLF problem; and disarmament (or arms control) proposals are again in the news, especially steps to prevent further "proliferation" of nuclear weapons.

While there were few efforts as yet to make New Year's predictions, it seemed clear that the changes and next steps were closely related to other headline news about the five "Great Powers." Communist China, having become the fifth nuclear power, showed no sign of softening its quarrels with either the Soviet Union or the U.S. President Johnson had his election triumph and room to pursue his own policies. Britain elected a Labor Government, pledged to more disarmament efforts and defense changes. The Soviet Government, following Khrushchev's ouster, was under new leadership. And DeGaulle, insistent on his concept of French and European, independent strength, seemed ready for a showdown over NATO and Western defense policy.

Multilateral Force

Since last spring, the U.S. has been pushing for creation of a special NATO surface fleet, armed with nuclear missiles, under multi-national direction but retaining a U.S. veto on use of the weapons. (*See June Newsletter* for background.) The proposal was designed mainly to give European allies, especially West Germany, more effective participation in NATO's nuclear deterrent, and to counter the French insistence on "nuclear independence."

By late fall, however, only the U.S. and West Germany still were in favor of the joint surface fleet as a means of strengthening NATO. DeGaulle was attacking the MLF, and NATO, at every turn, while pushing through a five year plan for France's nuclear "force de frappe." The Soviet Union had always opposed the MLF especially in terms of giving Germany any access to nuclear weapons. More recently, there were hints that if the MLF were set up, the East European bloc might be forced to create a Warsaw Pact counterpart. Then Britain's Labor Party, long skeptical of the MLF, indicated that it would seek a new look at NATO defenses.

And finally, President Johnson took his own new look at the fleet controversy and the divisions in the Western alliance, and began to stress that U.S. policy was "flexible."

In December, the winds of change blew up a flurry of new headlines. First, Britain's new Prime Minister Wilson and President Johnson held talks which apparently covered the whole range of defense and disarmament policies. Most important, Wilson outlined new proposals for a broadened multilateral force, including submarines and bombers, to which Britain would contribute. Secondly, NATO held its annual Council meeting in an unexpected atmosphere of harmony. The U.S. gave heavy emphasis to its commitment to the defense of Western Europe and, privately, its intention to "consult" DeGaulle on the strategy of defense. With the tacit consent of DeGaulle and the U.S., it was agreed that Britain, West Germany, and

(Continued on Page 3)

JOINT PROJECT — ATOMS-for-PEACE?

(See CANAL Page 1)

The possibility of joint East-West projects using nuclear explosives for mining and excavation was raised by atomic experts from the Soviet Union and Rumania at the Atoms-for-Peace Conference in Geneva last September. The Soviet overtures, although made informally on a scientist-to-scientist basis, mark a dramatic reversal in the Russian attitude towards Project Plowshare, the AEC's program for developing peaceful uses of nuclear explosives. Six years ago at the last Atoms-for-Peace Conference, the Soviets accused the U. S. of using Plowshare as a disguise for continuing atomic weapons development during the moratorium on weapons testing beginning at that time.

Plowshare Inhibited by Nuclear Test Ban Treaty

On a number of occasions American officials have said that the terms of the nuclear test ban treaty inhibit wide use of nuclear explosives for peaceful purposes. The treaty says, in effect, that fallout from underground nuclear tests — which the treaty sanctions — must be confined to the national boundaries of the blast. In the light of previous Soviet intransigence, American officials were never very optimistic that the treaty could be easily amended to exempt Plowshare detonations from this restriction. The U. S. had proposed such an exemption and the Soviets vetoed it. The prospect for treaty amendment now seems less remote in the light of this Soviet interest in Plowshare activities. (*Wash. Post*, 9/13/64).

New Panama Canal Contemplated

With President Johnson's announcement Dec. 18 that the U. S. intends to press for a new sea level canal in Central America, there would seem to be additional reason for working out the problems of peaceful nuclear explosives in relation to the test ban treaty. U. S. officials said that preliminary air surveys would help to determine whether the use of nuclear or conventional means would be more feasible in the building of the new canal. Nuclear excavation would be much cheaper but technical problems could preclude employment of this method. If the use of nuclear devices is proved feasible, the officials added, provisions of the nuclear test ban treaty would be relevant. However, the decision of feasibility may not be reached for three or four years. Feasibility studies, which will consider four possible routes, are scheduled to begin as soon as President Johnson names a five-man civilian commission for the job. (*Wash. Post*, 12/19/64 & 12/22/64; see also *Newsletter*, 3/64).

SCIENCE AND CULTURE

The Winter 1965 issue of DAEDALUS, the Journal of the American Academy of Arts and Sciences, has been entirely devoted to articles on the general subject of *Science and Culture*. Of special interest are the articles "The Established Dissenters" by Don K. Price, "Science in Modern Culture" by Eric Weil, and "Science and Man's Nature" by René Dubos. The articles go into great depth in trying to pin down the rôle of science in modern life, one even comparing science in the present day (and its threat to freedom) to that of the medieval Church in Europe. The issue as a whole is thought-provoking.

FAS NEWSLETTER

Published monthly except during July and August by the Federation of American Scientists, 2025 Eye St., N.W., Washington, D. C., 20006. Subscription price: \$2.00 per year.

Chairman.....Dr. Peter G. Bergmann
The FAS Newsletter is prepared in Washington.

Editor: Judith Eckerson

Writers: Leslie Gellert, F. K. Millar, David R. Davies

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

BODEGA HEAD NUCLEAR POWER REACTOR CANCELLED

Ending a controversy of several years standing, Pacific Gas & Electric Co., the nation's largest investor-owned utility, has decided to withdraw its application for an AEC permit to build a 325,000 electrical kilowatt boiling water reactor at the south end of Bodega Head on California's northern seacoast. The immediate cause of the decision was a report from the AEC's Division of Reactor Licensing which makes safety reviews of reactor licensing applications. The report concluded that "Bodega Head is not a suitable location for the proposed nuclear power plant at the present state of our knowledge".

Conflicting Reports on Safety Aspect

In reaching its conclusion, the AEC's regulatory staff differed, apparently for the first time, with the AEC's Advisory Committee on Reactor Safeguards which gave a favorable report on the Bodega Head project. The difference of opinion concerned the safety aspect arising from the fact that the proposed reactor site was approximately 1000 feet west of the earthquake-prone San Andreas fault zone. In the event of an earth shock, the reactor could be subjected not only to vibrational stresses but also to differential ground movement. The latter, according to the U. S. Coast and Geodetic Survey and the U. S. Geological Survey, might be in the 2-3-foot range. Although Pacific Gas & Electric felt that potential earth shock effects would be much less, the company had reworked its structural design for the reactor to meet the possibility of the more drastic effects. What the company submitted was a "pedestal concept", calling for 3 feet of radial clearance between the outside of the reactor containment building and the inside of the 98-foot-deep containment pit. The containment structure was to be founded on a layer of sand which, the company believed, would allow horizontal movement of the structure of up to 3 feet without harm to the structure or to its containment function.

The AEC's Advisory Committee on Reactor Safeguards, while recognizing that the reactor site would probably receive at least one major earth shock during its lifetime, believed nevertheless that Pacific Gas & Electric "has proposed methods for mechanical and structural design to meet the predicted seismic occurrences". However, the Division of Reactor Licensing did not agree. The report of the licensing staff acknowledged that "a new method is proposed for safeguarding the Bodega Head reactor against differential ground movement of its foundation rock. This is not in itself a cause for concern". Instead, according to the report, "what is of concern is the lack of any experimental or experience proof-test of the proposed novel method that could form an acceptable basis for the required safety evaluation. Because of the magnitude of possible consequences of a major rupture in the reactor containment accompanied by a failure of emergency equipment, we do not believe that a large nuclear power reactor should be the subject of a pioneering construction effort based on unverified engineering principles, however sound they may appear to be."

Opposition from Citizens' Groups

Since mid-1962, when Pacific Gas & Electric purchased 225 acres of Bodega Head, the company has had to fight a running battle with local and state citizens' groups opposed to the nuclear power project. Initially the issues at stake were related to conservation and land use, and, in the course of the controversy, the leader of the opposition — the Northern California Association To Preserve Bodega Head and Harbor, Inc. — grew from twelve to nearly 2,000 members. However, each attempt of this group to halt the project met with failure, as the fight was carried from the county to state level and finally to the Supreme Court of California. The state and local authorities would not judge the safety issue, apparently leaving this question to the AEC. Now that Pacific Gas & Electric has lost on the technical question of engineering, the California opposition is looking forward to the further job of making Bodega Head into a state park. (*Chemical & Engineering News*, 11/9/64; *AEC Release*, 10/27/64; *Nuclear Information*, 4/64).

RECENT PUBLICATIONS

LISTEN TO LEADERS IN SCIENCE, by Albert Love and James Saxon Childers (ed.). New York: David McKay Co., 1965. \$5.50.

This book is primarily intended for use by young people contemplating a career in science, describing in detail the various specialties available. It is written by literate men who are excellent, each in his field, at informative and enthusiastic salesmanship in the cause of science. After reading the collection, however, it is obvious that the multiple authors differ markedly in their opinions of their responsibilities, and the place of science in society, and that they have unwittingly produced a series of position papers. They run the gamut from Jackson W. Foster's benign view of biological warfare — BW for short (*microbiology*), to Roger Revelle's confidence that the need to farm the sea may unite mankind (*oceanography*). Glenn T. Seaborg (*chemistry*) simply lauds technology and avoids the rest. "In the home, we have color photography, hi-fi, the fabrics woven of the new miracle fibers that will not spot, stain, or wear out, and the plastic baby bottle."

Foster's article strikes a worrisome note: "these very substantial programs (biological warfare) sponsored by the U.S. Government are comparable to those in chemical warfare and atomic bombs. It is a matter of keeping our powder dry for reprisal in case we are attacked first." The article by James F. Crow (*genetics*) continues to evoke worry, "it is a fortunate accident of history that the mutation producing effects of radiation were understood before the discovery of nuclear energy; otherwise we might have been more careless in weapons testing and in disposal of radioactive wastes. There is a less well understood but possibly more important risk in the vast new store of chemicals that we come in contact with daily. It is not at all unlikely that among the variety of chemicals in smog, food additives, cosmetics, fabrics, and insecticides, there are some that are more harmful to man's genetic future than the radiation we hear so much about. I hope that in the future tests for mutagenic potency will become a standard part of the routine testing of new chemicals of widespread use." He does not doubt, however, that if causes and effects were understood that man could direct his own evolution wisely. "Natural selection is cruel, blundering, slow, and lacking in foresight. It has no criterion of excellence except the capacity to survive. . . . Selection under individual human control could be different."

George A. Miller (psychology) shows concern over the power that knowledge of man's mind gives to other men. "Some psychologists are confident that when we finally have improved techniques for manipulating people, we will use them in a benign and enlightened manner. But I can't help wondering about who will control the controllers." But he goes on to say, "science is ethically neutral," and "I doubt if it will come in my lifetime."

Revelle (oceanography) takes a more hopeful stand in his statement, "the ocean waters are indivisible, and events in one part of the sea eventually have profound effects at great distances. The scientific study of the sea is not only a natural field of international scientific cooperation, but such cooperation is necessary if human understanding of the oceans is to keep pace with human needs." And Henry G. Houghton (meteorology) also finds, "weather ignores national boundaries; close international cooperation is both natural and necessary."

Some of the differences in viewpoint are inherent in the fields of study, some are inherent in the men who wrote the book, but the varying opinions are in themselves informative to one who may read the book in an attempt to "evaluate science" as a potential career, or a historical phenomenon.

(Cont. from page 4)

acceptance letter, he wrote, "The population explosion has already become one of the most critical world problems of our time and daily grows more serious. It threatens to smother the economic progress of many nations and endangers the free world struggle for peace and security.

NEW DIRECTIONS

(Continued from Page One)

several other NATO members would undertake further negotiations on the form and substance of a multilateral force. (*N.Y. Times*, 12/9, 12/17.)

The "Proliferation" Problem

Communist China's nuclear test has given new drive to the long-standing effort to find ways of checking the spread of nuclear weapons. Most world leaders apparently continue to agree that it is bad enough that the existing nuclear powers can't yet be disarmed, and that time is running out for any efforts to forestall a new multi-national arms race.

Late in 1961 (after France entered the "nuclear club"), the UN General Assembly unanimously approved a recommendation, the so-called "Irish proposal," that States which had nuclear capacity should not transfer weapons or aid in their development by others, while non-nuclear States would pledge not to acquire their own nuclear arms. The U.S. and many others have favored an international agreement along these lines, and the problem has been discussed a good deal at the Geneva disarmament conference and in private U.S.-Soviet talks. For over a year, the possibility of formal agreement has been in suspense, since the Soviet Union insists that the NATO force proposal was incompatible with "non-proliferation."

Meanwhile, the U.S. is giving increasing attention to methods of curbing the spread of weapons and also to promoting safeguards on peaceful atomic energy programs. In addition to U.S. proposals at the Geneva Conference (see *March Newsletter*), examples are the U.S. effort to assign safeguard tasks to the International Atomic Energy Agency and a recent agreement whereby the IAEA will inspect the operations of a U.S. power reactor at Rowe, Massachusetts.

The new wave of urgency to get some agreement or action was underlined by President Johnson's announcement, on Nov. 1, that he had asked for a review of the "proliferation" problem by a special committee, headed by Roswell L. Gilpatric, until recently an Under Secretary of Defense.

The Committee is to study the whole field of U.S. policies concerning the spread of military and peaceful programs, and recommend steps to be taken by the U.S., alone or with others. (*N.Y. Times*, 11/1, 11/21.)

ENROLL A NEW FAS MEMBER NOW!

Federation of American Scientists, Suite 313, 2025 Eye St., N.W., Washington, D.C. 20006. I wish to support FAS by becoming a:

- Member
- Subscriber
- Contributor

NAME _____

ADDRESS _____

Membership Dues: Regular -\$7.50 (income below \$4500 -\$4)
 Supporting -\$10; Patron -\$25; Student -\$2
 Subscription to FAS Newsletter -\$2
 (10 issues per year; free to members)
 Contribution \$

Make check payable to: FAS

- Please send information on Group Life Insurance
- Please send information on special rates to FAS members for Bulletin of Atomic Scientists

NONCONTACTING TRANSDUCERS— LIE DETECTION AT A DISTANCE?

"We were led . . . to an evaluation of the present role and ultimate performance of transducers, particularly as to the ways in which the possibilities inherent in their development might affect the relations between persons and nations.

"One of the consequences of Heisenberg's principle in physics may be stated simply as indicating that the measuring instrument in some way, however slight, always affects the measurement. Nowhere is this more true than in the field of biology and medicine. All transducers load the phenomenon being observed . . . The act of handling or even speaking to a patient affects, sometimes markedly, the condition of a patient . . . In order to obtain true results from an animal or a patient, it is necessary to use more subtle measuring methods to obtain indications from a state as little altered as possible.

"Transducers are now available which produce a minimum of discomfort to the patient and can be left ingested or implanted for long periods. It is instructive to consider conceptually how far these principles might be carried to the limit by making completely noncontacting transducers which would not be attached to the patient by any methods palpable by him or of which he is otherwise aware.

"It is common in psychophysiology to monitor, among others, the following phenomena: respiration, temperature, galvanic skin resistance, blood pressure, pulse and electrocardiogram. A number of the possibilities for measuring these phenomena from a distance (10 M.) are considered. With the possible exception of the electrocardiogram which appears to be the most difficult, it seems that known technics should be capable of measuring these parameters although not yet at the desired distance. . . .

"We list some of these applications as follows:

1. *Lie Detectors.* In scientific interrogation it is common to use polygraph recorders measuring some of the phenomena referred to. Special schools for the interpretation of such recordings have been established to train police officers and investigate personnel. The availability of some of the technics considered would make possible much less inhibited responses, leaving aside the moral question of whether such contacts should be made without the subject's consent.

2. *Court Procedures.* Judges and juries take cognizance of those physiologic parameters which they can observe with their inherent electronic transducers. Considerable attention is paid to the timbre of a witness' voice, the rate at which he speaks, the flushing of his face and possible sweating in making a judgment as to whether he is telling the truth. Such judgments, if not rendered more accurately with the technics proposed, would at least be based on more information and less biased guesses. Already devices are under

development for integrating measurements of glossal motion, acoustic speech, respiration and oral temperature from a single transducer.

3. *In Diplomacy.* The installation of such equipment in diplomatic offices and at international conference sites might do much to encourage veracity on the part of the participants, or would at least make statements of policy, which are part of the political line of the particular country, much more readily appreciated in their true values.

4. *In Espionage and Surveillance.* The availability of such equipment might make less necessary the installation of "black boxes" for nuclear blast detection. It might be sufficient merely to examine a number of the representatives of the countries involved with or without their consent using the technics we have considered. The United Nations would perhaps be one of the prime prospects for the development and purchase of such equipment. In political debate, certainly every forum should be equipped with one of these devices . . .

5. The *art of electronic eavesdropping* has already been carried to considerable perfection. Most of the published methods still require some equipment installed in the room under surveillance. The recording of conversation from a distance might be made possible by a modification of the ultrasonic Doppler radar . . . operating from the laryngeal vibrations . . .

"The methods considered here are only those which have first occurred to us. Undoubtedly, much better ones can be conceived."

(Carl Berkley, in the December, 1963, issue of *Medical Electronics*, "Possibilities for Noncontacting Transducers.")

TWICE AS MUCH FOOD IN 1994

The present population growth rate of Asia, Africa and Latin American is 2.5% or greater. A rate of 2.5% per year will double the population every 28 years. According to the U.N. Provisional Report on World Population Prospects the world population will double the 1960 figure of 3,000 million by the end of this century. This figure may well be conservative if the fertility rate is maintained together with a decline in mortality.

Consequently the world's food supply must be doubled in the next thirty years in order to continue to feed people at the present level. In some countries where the rate of growth is above 2.5% and where the population is already at the subsistence point, famine is now practically certain.

President Eisenhower has reversed his 1959 view that the U.S. Government should stay out of the birth control promotion in underdeveloped countries, and agreed to serve as co-chairman of the honorary sponsors council of Planned Parenthood — World Population with President Truman. In his

(Cont. on page 3)

FAS NEWSLETTER

Federation of American Scientists
Suite 313
2025 Eye Street, N.W.
Washington, D. C. 20006

Volume 17, No. 10

December, 1964

Second Class Postage
Paid at
Washington, D. C.

Return Postage
Guaranteed