GENERAL SCIENCE

Atoms for Peace

Numerous peaceful uses of atomic energy, ranging from blasting new harbors to cancer therapy, will be discussed at the United Nations conference to deal with the question.

By WATSON DAVIS

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➤ THE SECOND United Nations International Conference on the Peaceful Uses of Atomic Energy will last two weeks, beginning Sept. 1, in Geneva, Switzerland, with probably 5,000 in attendance, including delegates, scientists, press and observers.

It will be bigger than the first such meeting in 1955 with more than double the papers, double the governments and organizations participating.

The statisticians have figured out that some 2,400 papers from 65 governments and nine international agencies have been submitted. Only 600 papers will be actually presented to sessions. Even so, the flood of papers for delegates and press will amount to 550 tons of paper weight, since there will be abstracts, press releases, as well as copies of the communications given priority for presentation.

On most days there will be five sessions running at the same time. The conference goes on morning, afternoon and night, except for Sunday.

In the photograph on the cover of this week's SCIENCE NEWS LETTER Mitchell Thomas (left) and William M. Field (right) adjust the Stellerator which is part of the "Sherwood Project" area of the United States' demonstration of thermonuclear research.

World-Wide Organizations

Since the first conference, the atomic organizations have multiplied luxuriantly. The United Nations set up in Vienna the International Atomic Energy Agency, primarily to supply atomic fuels to countries that do not have uranium enrichment plants and to ensure that the fuels provided do not get diverted for making bombs to endanger the peace of the world. Then there is the European Nuclear Energy Agency set up by the Organization for European Economic Cooperation (OEEC) that works out joint development programs, international trade and security and standardization.

A treaty between Germany, France, Belgium, Italy, Luxembourg and the Netherlands results in Euratom for the development of atomic power. In this the United States and Britain cooperate.

A whole new category of science, engineering and technology has been created to serve the atomic world. There is an acute shortage of experts. As a result the United States particularly has engaged in international training programs of considerable extent.

Three years after the first Atoms for Peace Geneva conference there are only two nuclear power plants of major size actually operating. But some 34 additional major-size power plants run by fissioning of atoms are under construction or planned, and several of them will be in use later this year or next.

The largest atomic power plant is at Calder Hall in Britain, with 92,000 kilowatt output, and the second largest is American at Shippingport, Pa., with 60,000 kilowatt output. In the United States seven other plants are operating, all small with one of them a 2,000 kilowatt packaged power reactor that can be moved from place to place if need arises. Soviet Russia has only the 5,000 kilowatt plant that started operating in 1954 and put the Russians ahead at the 1955 Atoms conference, but the first of five 70,000 kilowatt plants of various types is scheduled to be finished this year.

Under construction in the United States there are four large plants, with a total of 577,000 kilowatt output, and 12 major plants are in the planning stage. But Britain has 1,686,000 kilowatt capacity in seven plants building, one a duplicate of Calder Hall about to go to work.

By 1963 the United States will have atomic power plants generating 1,326,500 kilowatts of electric power, with two plants totalling 290,000 kilowatts due in 1960 and 379,400 kilowatts more in 1961.

France has two plants, totalling 150,000 kilowatts, building, and Canada one of 20,000 kilowatts. Italy and Japan are buying power stations from Britain. Belgium is obtaining one from the United States.

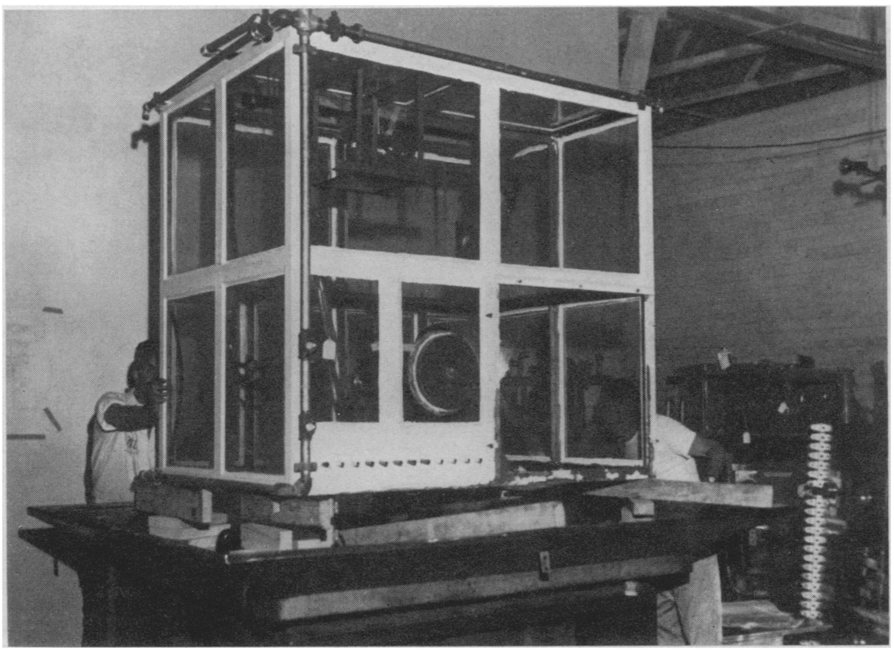
Sweden will describe at the conference "Adam," a 75,000 kilowatt reactor for house-heating.

At the first atomic conference in 1955 the operating "swimming pool" research reactor of low power installed by the United States was the hit of the exhibition. This year a similar U. S. reactor has been operating at the Brussels World Fair. In all, 26 research reactors have been or are being built in the United States for use in foreign locations. At this year's atomic conference there are two working fission reactors, a ten thermal kilowatt device that will be assembled before the eyes of the visitors and an isotope producing reactor called TRIGA.

Atomic Specialists Needed

A major effort at training atomic specialists has been made since 1955 by the United States at atomic centers. One of these, Argonne National Laboratory at Lemont, Ill., expects to have 70 of the 421 students at its international courses attend an "alumni reunion" at Geneva this year.

Atomic power has begun to conquer the seas. The United States has six nuclear-powered submarines operating, and two of them, the Nautilus and the Skate, made the northwest passage under the arctic ice. Two more nuclear submarines have been launched, 14 are being built, and a nuclear-powered guided missile cruiser and aircraft carrier are being built. The keel has been



ATOMIC GREENHOUSE—Workmen unload and adjust the "greenhouse" where the effects of radioisotopes on plant structures will be demonstrated.

laid for the first U. S. atomic merchant ship, the Savannah.

Russia has an atomic icebreaker about to operate, while Japan is designing an atomic submarine tanker.

In the air, no atomic powered aircraft have yet flown but the United States and Russia have reactors for such use under development and construction. Nuclear rocket propulsion is being investigated in the U. S. Atomic Energy project Rover, while project Pluto is determining the feasibility of applying heat from a reactor to ramjet engines.

Natural uranium is the simplest fuel for power reactors and this is being used by Britain's big plants, while the United States reactors use enriched uranium, that is, uranium containing more than the natural percentage of isotope 235. Only the U. S. and the U.S.S.R. have plants for enriching uranium.

Potential Power Fuel

Another fissionable fuel, plutonium isotope 239 made by the action of neutrons on the common natural uranium isotope 238, is a potential power fuel but so far it has been used only in bombs. The United States is studying for the future a big reactor that would produce large amounts of plutonium and 700,000 kilowatts of electric power. Still another atomic fuel, uranium fissionable isotope 233 made by similarly bombarding thorium with neutrons from reactors, is still farther from practical production and utilization.

Considerable improvement has been made in the material used in building atomic reactors, particularly the fuel elements that undergo intense radiation in the reactor cores. American research has shown that if uranium is alloyed with zirconium and molybdenum it will remain stable under irradiation. This advance is being exhibited at Geneva.

Thermonuclear Power Near

The possibility of the production of power by controlling and utilizing the reaction of the H-bomb, the thermonuclear power, was merely a dream at the time of the first Atoms for Peace conference in 1955. The president of that conference, Dr. Homi Bhabha of India, told how by extracting deuterium from seawater the world could have almost inexhaustible power for its future if H-bomb power can be controlled.

That control has not been achieved yet, although for a time last year it was thought that a sustained fusion reaction had been achieved in Britain. The scientists have not yet arrived at a stage in thermonuclear power equivalent to the famous Dec. 2, 1942, demonstration of the first self-sustaining fission reaction.

When Dr. Bhabha exploded his speculation that controlled fusion could come in 20 years, it was only surmised that the U. S., Britain and the U.S.S.R. were doing thermonuclear power research. As a matter of fact, American research was underway during World War II even before the fission bomb and fission power were achieved. The latest Atomic Energy Commission report admits that secret research was formally inaugurated as early as 1951, but has been accelerated in the past few years.

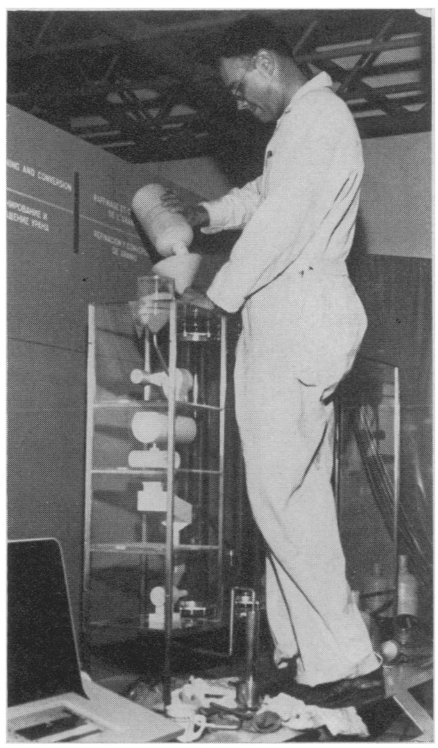
British and Americans have jointly announced some of their results, while the Russians released some information even earlier. There is anticipatory speculation on what will be presented in controlled thermonuclear progress at the Geneva conference, especially by the Russians. There will be a total of some 15 hours of papers on controlled fusion. The United States is sending an extensive series of exhibits on its Project Sherwood, as the U. S. controlled fusion program is called.

To achieve power from thermonuclear reactions the heavy hydrogen must be brought to at least 100,000,000 degrees centigrade. So far only several million degrees have been achieved. Then the hot gas, or plasma as it is called, has to be held together for an appreciable length of time. This is very far from being achieved.

If this reaction were made self-sustaining and its energy harnessed, the world would have a source of energy that should last a billion years. The fuel, deuterium, could be extracted from the oceans at a cost of less than one percent of the cost of coal.

Although a major effort is being expended on H-power, the program for obtaining "conventional atomic" power from uranium is being developed consistently.

Being taken to Geneva for the U. S. exhibit are nine laboratory thermonuclear machines, which bear such labels as stellerator, magnetic mirror, perhapsatron, plasma accelerator, triaxial pinch machine, etc. These are the devices that may bring a breakthrough in H-power in the future.



URANIUM REFINING — Dr. John C. Breese of Oak Ridge National Laboratory, prepares a working scale model of a uranium refining apparatus. It is part of the fuel cycle demonstration being presented at the Second International Conference on the Peaceful Uses of Atomic Energy.

Isotopes: Useful Radiation

While spectacular explosions of atomic bombs or giant reactors for power attract more public attention, radioactive isotopes are more widely used throughout the world.

Isotopes, manufactured in atomic furnaces or in special reactors, are used as sources of radiation or as "tracers" in medicine, agriculture, industry and scientific research. The little explosions of atoms in the isotopes produce useful radiation or give notice of the isotopes in minute amounts.

Countries very far from production of atomic power are benefiting from the use of radioisotopes in the diagnosis and therapy of disease.

At the Geneva conference 17 countries will report on a single isotope application, the use of iodine 131 for detecting and treating thyroid disorders. Techniques for using that isotope, which has a tendency to seek out the thyroid gland and can be readily detected there, are described by Belgium, Brazil, China, France, Greece, India, Israel, Japan, the Philippines, Portugal, Romania, the U.S.S.R., the United Arab Republic, the United Kingdom, the United States, Uruguay and Venezuela.

In cancer therapy, several papers describe experimental use of the boron-neutron technique for localized treatment, particularly against brain tumors. In this application, boron, which tends to concenrate in tumor tissue, is injected and the tumor site is bombarded with a beam of neutrons from a reactor. The boron absorbs the neutrons and emits alpha radiation which is effective locally, destroying the tumorous cells with little damage to healthy tissue nearby.

Agriculture to Zoology

In the agricultural field, some 90 papers from a large number of countries cite use of radioisotopes as tracers in studies of fertilizer action, soil characteristics and livestock diseases; as sources of radiation for inducing mutations that may lead to better plant varieties and disease-resistant crops; and for preservation of food through sterilization.

In industrial applications, numerous papers indicate spreading adoption of techniques previously reported for using radioisotopes as measuring devices, in controlling assembly-line operations, and in changing the characteristics of certain materials.

A Soviet paper describes treatment of silkworm cocoons by radiation, and a Japanese study reports that isotopes can be used to detect fingerprints that would not show up in conventional tests.

A fully equipped radiochemical tracer laboratory is being exhibited by the U. S. Atomic Energy Commission at Geneva. It shows the radioactive labeling of two drugs, isoniazid with carbon-14, and diamox with sulfur 35. Isoniazid is a widely used drug for combating tuberculosis and diamox is

(Continued on p. 141)

REPORT OF THE HIGH-STRENGTH, HIGH-TEMPERATURE MATERIALS FOR STANDARD PARTS SYMPOSIUM — Charles Sheckells, Chairman — *Nat. Standards Assn.*, 393 p., illus., paper, $5. Discusses materials needed for missiles, satellites and rockets.

SAFE DESIGN AND USE OF INDUSTRIAL BETA-RAY SOURCES—Subcommittee on Sealed Beta-Ray Sources of ASA Z54 Sectional Committee—*Govt. Printing Office*, NBS Handbook 66, 28 p., illus., paper, 20¢. Discusses aspects of personnel protection.

SAMARIA: The Capital of the Kingdom of Israel—André Parrot—*Philosophical Lib.*, 143 p., illus., $2.75. Archaeology here reconstructs the stage on which the prophets Elijah and Elisha played their parts.

SPELEO DIGEST 1957—John R. Dunn and William B. White, Eds.—*Pittsburgh Grotto (Speleo Digest)*, 292 p., illus., paper, $3. Collection of writings on the discovery of caves and new data on known ones.

THE STATISTICS OF METEORS IN THE EARTH'S ATMOSPHERE—Gerald S. Hawkins and Richard B. Southworth—*Govt. Printing Office* for Smithsonian, 16 p., paper, 50¢. Of interest to those concerned with the technical problems of the upper atmosphere.

THE STORY OF THE WINGED-S: An Autobiography—Igor I. Sikorsky—*Dodd*, 4th ed., 280 p., illus., $4. With new chapter on recent, successful helicopter experiments.

TEXTBOOK OF ORGANIC CHEMISTRY—Lloyd N. Ferguson—*Van Nostrand*, 618 p., illus., $7.50. For students of elementary organic chemistry, with study guides and references.

TOPOLOGICAL ANALYSIS — Gorden Thomas Whyburn—*Princeton Univ. Press*, 119 p., $4. Centered around results obtainable with the aid of the circulation index of a mapping and properties resulting from openness of a mapping.

TRANSACTIONS OF THE CONFERENCE ON THE USE OF SOLAR ENERGY: The Scientific Basis, 5 vols.—Edwin F. Carpenter, Ed.—*Univ. of Ariz. Press*, 887 p., illus., paper, $12.50 per set. On available energy measurement of the radiation, high temperature furnaces, solar heating, photochemical and electrical processes.

THE TRUE BOOK OF ROCKS AND MINERALS—Illa Podendorf—*Childrens Press*, 48 p., illus. by George Rhoads, $2. A child's introduction to the world of rocks.

WONDERS OF THE HIVE—Sigmund A. Lavine —*Dodd*, 92 p., illus., $2.95. About all types of bees—solitary, carpenter, mason, mining, social and stingless bees.

WOODLAND ECOLOGY—Ernest Neal—*Harvard Univ. Press*, 117 p., illus., $1.75. For students and naturalists who wish to learn more about the lives and relationships of animals and plants.

THE WORLD OF CARBON—Isaac Asimov—*Abelard-Schuman*, 178 p., diagrams by author, $2.75. Makes the carbon part of organic chemistry a story of absorbing interest to the general reader.

YOU AND THE EARTH BENEATH US—Julian May—*Childrens Press*, 63 p., illus. by Beth Wilson, $2. Introducing the child to the earth's crust and the forces that made it.

Science News Letter, August 30, 1958

An antibiotic prepared from a commonly found skin organism is highly effective in protecting animals against lethal inoculations of Clostridium septicum, the organism that produces gas gangrene.

The earliest known copper-nickel alloy *coins* are those minted about 170 B.C. in Bactria, India.

Atoms for Peace

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used in the treatment of cardiac attack, glaucoma and epilepsy. Radioautographs will be exhibited to show the effect of these drugs on the central nervous system and as a check on drug concentration that actually reaches various parts of the body.

A number of organic materials will be tagged with tritium, or radioactive hydrogen, isotope 3, by direct exposure to the gas. Since hydrogen is a constituent of most organic matter, almost any organic compound can be labeled with tritium to form an isotope with a relative high specific activity. The specific procedure for labeling with tritium will be demonstrated. Particularly interesting will be the tagging of adenine with tritium. A constituent of nucleic acids, which are contained in all cell nuclei, tagged adenine is becoming increasingly useful in the study of cell structure and activity.

The exhibit will also demonstrate the assaying of tritium and C-14 in various organic materials by a rapid and precise simplified technique.

A traveling isotope laboratory built as a self-powered bus will show Geneva atomic visitors how isotopes are handled and used. It is one of two mobile radioisotope laboratories that the United States is giving to the International Atomic Energy Agency in Vienna for giving radioisotope training courses at universities and research institutions throughout the world. Six students at a time can be given basic training in how to handle radioisotopes.

In the Los Alamos cryogenics exhibit, actual experiments with two kinds of isotopes of helium will be performed at 0.5 degrees Kelvin, very near to absolute zero degrees Kelvin, which is equal to 459.72 degrees Fahrenheit below zero. The exhibit will show the spontaneous separation of helium-3 and helium-4 at extremely low temperatures. This was originally predicted by scientists of the Los Alamos Scientific Laboratory, observed at Duke University and first photographed by Russians. The two kinds of helium separate into layers. The bottom layer, rich in helium-4, is superfluid and can pass through extremely fine cracks that can not be penetrated by other gases or liquids.

How nuclear radiation can be used to perform atomic surgery will be shown at a University of Chicago exhibit. Pellets of radioactive yttrium-90 are injected by a needle through the nose and into the pituitary gland of a life-size model to simulate an actual operation, which is guided by electronic X-ray fluoroscopes.

An atomic farm will be operated by the U. S. Argonne National Laboratory, as a small completely sealed greenhouse in which plants are grown in a radioactive atmosphere. There will also be a "radioactive restaurant for rats," an automatic feeding device which delivers carbon-14 labeled foods at definite intervals to rats.

Moving Mountains

Conventional earth moving fades into insignificance beside the prospects of atomic excavation, the use of hydrogen bombs for hollowing out harbors, blasting through mountains to change the course of rivers and performing other feats of rearranging the contours of the earth.

One of the reports from the United States

Questions

ASTRONAUTICS — How is the plasma "pinched" in the proposed magnetic pinch plasma engine? p. 133.

EVOLUTION—Who is credited with first proposing that higher animals evolved from flatworm-like animals? p. 135.

GEOPHYSICS—What is one possible way that the rate of carbon-14 production may have changed? p. 137.

MEDICINE—What are the symptoms of lupus? p. 131.

PUBLIC HEALTH—How many persons suffer from malaria? p. 137.

Photographs: Cover and pp. 138, 139, United States Information Agency; p. 131, Bermuda News Bureau-Gene Ray; p. 133, Republic Aviation Corp.; p. 135, National Bureau of Standards; p. 144, Ambulitter Corp.

Do You Know?

The *copeopods,* crustaceans only a small fraction of an inch long, are so abundant in the ocean that the whalebone whale (which may be 100 feet long) feeds on them, straining them out of the water with its baleen-fringed mouth.

Tidal waves are caused by underwater earth tremors, tropical storms and other geophysical phenomena, and often cause enormous destruction.

The nuclear *membrane* of a cell has been described as a double-layered fenestrated envelope with raised ring-like structures surrounding "pore-like" areas.

As sweet *corn* matures, the sugar content of the kernel increases to a maximum level and then quite rapidly declines.

Anaerobic metabolism is the process whereby tissue can exist with a shortage of oxygen.

Lime is one of the oldest building materials.

to the conference tells of the studies made at the University of California Radiation Laboratory, Livermore, Calif., under the code name of Project Plowshare.

There are surveys already underway to create by a H-bomb explosion a new harbor to open the mineral riches of the arctic Alaskan coast to the outside world.

Hydrogen fusion bombs will be used for these engineering projects because they can be made relatively "clean" with a minimum of radioactive fallout.

Atomic Creations

In addition to carving the face of nature with a Gargantuan flourish, atomic explosives may in the future:

1. Create deep underground stores of energy in the form of heat that can be tapped and put to work.
2. Distill, by enormous heat, tar sands and oil shales in place in the earth layers so that the petroleum they contain can be extracted by pumping.
3. Break up low-grade ore deposits to allow them to be leached and their valuable minerals recovered more easily.
4. Form underground reservoirs for water by breaking up layers of impermeable ground by the H-explosions, allowing rains to penetrate and collect for future use.
5. Manufacture large quantities of radioactive isotopes by wrapping around the underground explosions materials to be transformed by the explosion's radiation, giving ample quantities not only for medicine, agriculture and industry, but the production of energy of commercial use.

The U. S. Atomic Energy Commission has already announced that it will detonate a small nuclear "device" underground in salt beds about 25 miles southeast from Carlsbad, N. Mex., next summer (1959). The explosion would be at the bottom of a 1,200-foot shaft drilled in the salt beds so that heat developed would be confined to a relatively small area.

Hope for Future

On Sept. 19, 1957, an underground test, coded Rainier, was fired 800 feet down in Nevada. This showed that underground atomic explosions would not contaminate ground water or produce other harmful effects on the area.

For such underground blasts, relatively small atomic explosions of the fission sort would be used. The forthcoming New Mexico test will use the equivalent of 10,000 tons of high explosives. For excavating and earth moving, larger explosions of the order of a million tons of TNT equivalent would be needed and they would be of the fusion type to keep radioactive contamination as low as possible.

There were reports a few years ago from Russia that atomic bombs were planned or used for blasting new river channels and other such purposes, but details were never revealed.

Atomic energy is about to do new important jobs that may rival in usefulness power production, ship propulsion, and the host of other achievements already pioneered.