MATHEMATICS

Math Aids Missile Shoots

➤ THE "MONTE CARLO" method is being used to calculate the impact point of missiles, Dr. W. F. Bauer of the Space Technology Laboratories, Los Angeles, reports.

The Monte Carlo method is an advanced mathematical version of what is known as the "drunken walk problem." The drunken walk problem is so called because, using the simple rule that every step of an inebriate is as likely to be a step backwards as a step forward, a random, or unpredictable, path can be obtained.

In the Monte Carlo method, a mathematical game of chance more complicated than a drunken walk is devised. Reason for the game is to produce a random variable with an expected value that will be the solution of a certain problem. Thus the method is a way of solving physical problems using a series of statistical experiments that are performed by applying mathematical operations to random numbers.

Calculations involved in solving problems by the Monte Carlo method are so complicated that electronic computers are used to do the job in most instances.

One of the early applications of the technique was in solving the problem of how far neutrons in a nuclear reactor penetrate surrounding slabs of material. This is a problem similar to that of the drunken walk but with the added dimension of up and down.

The impact point of a missile is also a random variable because of unpredictable changes in the guidance system resulting from difficulties with radar propagation and from electrical circuit "noise." The missile's path is simulated on the basis of the character of these random variables.

Dr. N. Metropolis, formerly of Los Alamos Scientific Laboratory and now at the University of Chicago, and Dr. S. Ulam of Los Alamos, are credited with coining the picturesque name, "Monte Carlo," for the method used to define the relationship between probability problems and mathematical equations.

Dr. Bauer's report on present uses of the Monte Carlo method, including a section on the new solution of elliptic partial differential equations with certain boundary conditions, appears in the *Journal of the Society of Industrial and Applied Mathematics* (Dec.).

Science News Letter, December 27, 1958

METEOROLOGY

Winter Weather Due

➤ A "VIGOROUS circulation" covering most of the North American continent is bringing the northern U. S. its very wintry weather.

Jerome Namias, head of the U. S. Weather Bureau's extended forecast section, said the prevailing weather pattern was giving meteorologists an excellent example of the change from fall to winter weather. A very strong, upper level anti-cyclone (high pressure area) over the polar basin poured its cold air down into the U. S. at frequent and regular intervals.

The cold air sweeping southward from the Arctic was actually warmer than normal for polar regions during December. It flowed so fast, however, that by the time it had reached the northern U. S., it was much colder than normals there. This is because the air reached more southerly latitudes faster than the normals change.

The cold air masses pouring down from the Arctic hit western Canada first, then traveled across the Plains states and on to the East Coast. The icy journey from the Yukon down takes three days or a little more.

The pattern of a very high pressure area over the Arctic began showing up on pressure maps of the upper atmosphere about mid-November, Mr. Namias said, and then remained quite steady, showing all the signs that go with an early winter. The upper air pattern did not favor sinking, or subsidence, of the cold polar air, which would warm the air.

The jet stream's recent average position has been about 40 to 45 degrees north latitude, much farther north than last year, although it is expected to start shifting southward soon. The jet stream, influential in directing surface weather patterns, reaches its farthest north position usually in August or September, and its most southerly in February and early March.

The jet stream is a broad river of swift-flowing air found circling the earth some 30,000 feet above the earth's surface. Its meanderings and undulations resemble those taken by a river, but the jet stream makes a continuous circle of the Northern Hemisphere.

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MEDICINE

Hyperthyroidism Helps X-Ray Treatment

➤ BY MAKING cancer victims hyperthyroids, physicians may have greater success in treating cancer.

Experiments with humans and rats and mice show a synthetic thyroid hormone can cut in half the X-ray dose needed for cancer treatment, two scientists report in *Nature*. (Dec. 13).

Of 400 animals given injections of the hormone triiodothyronine, after they received tumor transplants and then were treated with X-rays, 103 rats and mice survived. All animals had showed the symptoms of hyperthyroidism, such as irritability, large appetite, loss of weight and nervousness.

Among the survivors, tumors disappeared in four weeks although the radiation dose they received was half that given control, or normal thyroid, animals.

Similar success was reported with reducing the amount of radiation used in treating two human volunteers, Drs. Joseph A. Stein and Melvin L. Griem of the University of Chicago report.

"Regression of tumor masses was unequivocal at one-third the dose level (1,500 rads) at which such a response might ordinarily be expected," they say.

The hormone may make radiation more effective by stepping up the cells' metabolism and increasing their supply of oxygen.

Dr. Stein is now back at his post at Hebrew University's Hadassah Medical School, Jerusalem, Israel.

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PSYCHIATRY

Russian Mental Patients Get "Tender Care"

➤ RUSSIAN mental patients are getting "tender, loving care," according to an American visitor to Moscow's largest mental hospital.

Robert H. Klein, mental hospital service consultant for the American Psychiatric Association, says the hospital staff members "seem genuinely dedicated to their jobs."

Mr. Klein expresses surprise at finding such "fine hospital care under a government which we have had been led to believe is completely uninterested in the individual except as he serves the state."

Reporting in the APA journal *Mental Hospitals* (Dec.), he wonders whether the Russians believe it is cheaper and more efficient to cure the mentally ill and return them to work. "Whatever the reasons," Mr. Klein says, "the prevailing philosophy at Kashenko (the Moscow hospital) is that its patients can either be cured or improved sufficiently to return home within a short time."

Tranquilizers have been used extensively in the past five years, he reports. Among other treatments, Mr. Klein found that special diets are employed in some cases because of a Russian belief that certain mental disorders are affected by nutrition.

A small number of patients are transferred, before discharge from Kashenko, to a sort of "half-way house" on the hospital grounds. Here the patients are given more freedom and wear normal clothes. There are no locked doors and facilities include a library, game room, and a comfortably furnished living room with radio and television. "Half-way house" patients receive the same types of treatment as in the hospital, but the proportion of staff to patients is much higher than in the hospital.

An average of 41 rubles a day per patient is spent at the 2,500-bed Kashenko. Based on various exchange rates, this may range from $1.36 to $10.25. Costs in the U. S. vary from less than $2 per day to more than $25.

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