GENERAL SCIENCE

Atomic Retaliation Jeopardized

Evidence is now strong that the whole highly elaborate U.S. retaliatory system of electronic communications against foreign attack could be nullified by a single high-altitude bomb.

By WATSON DAVIS

➤ THE ENTIRE nuclear defense of the United States is in jeopardy because of an atomic bomb effect which has so far been kept under strict secrecy.

Realization has grown that the explosion of an atomic bomb, either the old-fashioned fission kind or the hydrogen or nuclear fusion sort, sets up extremely high and powerful radiation of an electrical nature.

The electromagnetic pulse, EMP, as it is called, has the effect of putting out of commission the ordinary electrical control systems that must be relied on to launch and guide our missiles that would carry retaliatory atomic warheads to the enemy which makes an atomic attack on the nation.

The explosion of an enemy bomb within even a few hundred miles of one of our atomic missiles ready to be launched would put it out of commission unless the control and launching mechanisms are redesigned to withstand these effects. It is not necessary for the enemy bomb to make a direct hit.

EMP Effects

These EMP effects were demonstrated vividly during the high altitude tests of 1958 in the South Atlantic and 1962 in the South Pacific.

The EMP phenomenon had been observed from the very beginning of atomic testing in 1945. But the magnitude of the effects and their seriousness has been realized most vividly in the last decade.

The United States is pledged not to launch atomic bombs first. But it would utilize its gigantic nuclear strength in retaliation for an atomic strike at our country or our allies. The disabling effects of EMP created by bombs fired at us are of extreme seriousness. In effect, a thermonuclear hydrogen fusion bomb of 50 megatons, a size that can be expected in actual warfare, would virtually wipe out catastrophically the electrical and electronic systems within a radius of 120 miles of where it strikes.

Even outside this area there would be many damaging effects. Smaller bombs would have smaller areas of complete disaster but their effects, too, would be very extensive.

The scientists and the military charged with our atomic defense and attack are most concerned about the effect of EMP upon the electrical circuitry that will control in launching and in flight and the electronic trigger mechanism of our Minuteman missiles as well as the Titan and Atlas missiles, all of which are land based.

Less vulnerable would be the submarine-launched Polaris missiles which are on the alert in relatively large numbers under the sea.

There is research underway, under pressure, to counter the effects of EMP by what is called "hardening." This involves redesigning all of the modern circuitry including antennas, the electronic triggers that set off the bombs, circuits in inertial guidance systems, and the long lines of communication from control centers which would give the orders to put the retaliatory firing of nuclear missiles in action.

Kept Under Security Wraps

Ironically, information about EMP has been kept under such security wraps that the first detailed information has come to the public through revelations made by two reserve major generals, one in the Air Force and one in the Army, who are U.S. Senators. During the test ban treaty debate in the Senate, Senators Barry Goldwater (R-Ariz.) and Strom Thurmond (D-S. C.), both of whom opposed the ratification of the treaty, put into the proceedings of Congress to support their stand technical data, which previously had not been available. (Congressional Record, 109:16656, 1963).

Sen. Goldwater introduced into the Record a paper prepared by Dr. V. W. Vodicka, technical director of Joslyn Electronic Systems Division, and Dr. John A. Kuypers of Stanford University.

The explosion of an atomic bomb causes a gigantic electrical surge of extremely high voltage although of short duration. Even the early old-fashioned fission bombs of relatively small size caused increases in voltages on power lines in the region where they were exploded. Circuit breakers on main feed lines were tripped due to the excessive voltage and this effect was felt in areas more than 80 miles from where the bomb was exploded.

Instrumentation Failures

Most of the instrumentation failures that plagued early bomb tests were due to this effect. The effect cannot be avoided by covering cables with earth because buried cables suffer along with antenna and other electrical devices exposed above ground. Insulation is destroyed by the excessive voltages of EMP and the excessive strength of the electrical current that runs along the conductors to distant terminals and puts them out of action.

Research of the highest priority today in connection with defense activities includes the redesign of our existing electrical and electronic systems, including radar, to avoid the danger of their being put out of action by the EMP effects of enemy atomic attack.

Those working on our scientific research have been hampered by lack of information on the EMP and associated atomic effects, although there has been distributed, with a secret classification, studies and information which are not yet available to the general public.

Most of the information that is known generally comes from foreign unclassified sources such as technical magazines and reports. The Vodicka-Kuypers report says that "our systems design and implementation remains in the horse and buggy stage with respect to nuclear electromagnetic effects."

Besides the EMP effect the nuclear explosions cause other electromagnetic disturbances. In every high altitude test, by both Americans and Russians since 1953, artificial auroras have been produced. This is the so-called Argus effect because it was most prominently recognized in the U.S. Argus test series in the South Atlantic in August 1958. An atomic bomb can create a man-made aurora at any desired location that is equal to the electrical disturbance of any recorded sunspot storm.

This aurora causes severe electrical disturbances that affect radio and cable communications more severely than sunspots. In 1958 a low-yield shot at only a 200-mile altitude in the South Atlantic caused the undersea coaxial cable across the North Atlantic, thousands of miles away, to fail to function from time to time.

Other Blast Effects

Other nuclear blast effects, electrical in their nature, are:

1. Bursts of neutrons, which like the EMP cause abnormal voltages in electrical wires, and result in insulation breakdowns due to heat, chemical change and other effects.

2. A sort of artificial lightning, a static discharge effect, which particularly damages radio antennas and other metal of the electrical systems above ground. Some of these effects are sufficient to melt the structural compounds and cause a collapse of the antenna.

3. Radio transmission is affected seriously, particularly in the low-frequency and ultra-low-frequency ranges of radio communication.

4. Great bursts of gamma rays or X-rays are produced by a nuclear explosion. The effects of these are very serious and some information suggests that the atomic bomb blast will melt the plutonium and fusionable light element compounds that comprise the warheads of the nuclear bombs which we rely on to fling in retaliation to an attack upon this country.

Experts are concerned that there are no reliable data compilations, such as a handbook, that can be used by the thousands of engineers and scientists who are working on our communications and weapons

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Atomic Retaliation

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systems which must be redesigned and "hardened" in order to take care of the EMP and other nuclear explosion effects.

The electrical effects of atomic explosion which are now causing great concern are additional to the radiation, blast and extreme heat which would be produced by gigantic H-bomb explosions. These effects are better known and have been better publicized in connection with civilian defense than the electrical effects. But they are fundamentally no more serious from the standpoint of our counter measures and the defense of the country.

The electromagnetic effects which are now becoming realized are additional bomb dangers.

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GENERAL SCIENCE

Momentous Problem: Finding A Place to Live

➤ A NEW ECONOMIC ORDER is taking place throughout American farms, country areas and cities.

This new shape is changing the American scene in dynamic ways that should be analyzed, developed and directed in aiding establishment of a deep-rooted U.S. dream for a clean, orderly, happy secure home.

The signs of change are everywhere, states Orville L. Freeman, Secretary of the U.S. Department of Agriculture. Communities are growing or declining; farms are being enlarged or are disappearing; cities are being built up and suburbs are growing; families are moving to new homes and jobs; and human relationships, institutions and aspirations are changing in rural and urban America alike.

Clear-sighted perspective on these dynamic changes in American life is given in the USDA's official yearbook, "A Place to Live," published Nov. 4.

In the book's foreword, Mr. Freeman states that the new economic order is a product of a technological-scientific revolution that began 200 years ago and has increased its pace tremendously in the last few years. This order has affected agricultural production "almost beyond belief," he says, but has also had sorrowful effects on farmers and communities that could not keep up with the fast pace.

Warning signals should be heeded in some of the changes which, he says, "like an automobile out of control, are so fast, so undirected or so unmindful of traffic signs and lights as to jeopardize the well-being of people."

Farmers whose farms are too small, poor or rugged for machines have suffered many disadvantages. Many have moved into the cities, where new problems confront them. With traditional distinctions between city and country lessening, new situations call for more land for industry, more education, more technical services in planning cities, surburbs, highways, recreation areas and farming.

The 608 page yearbook sets forth information about farm problems, social and economic aspects of movements to and from farms, and the USDA's programs on factors that affect us all—the use of land, water, forests, open spaces, air, rivers and seashores.

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GENERAL SCIENCE

President Signs Law Against Human Miseries

➤ THE "MISERIES of the human mind" were attacked in the bill President Kennedy signed in Washington, D. C., authorizing a program to help reduce the occurrence of mental retardation and improve the health of mothers and children.

Quoting Albert Einstein, the President told the National Association for Mental Retardation that man had "conquered the atom" but not yet these human miseries. He referred to the 126,000 children born each year with some retardation—almost 5,000 of them so severely retarded that they "cannot care for their own needs."

With money to pay for so many things, the President said, the United States should make a major effort to block, stop or cure mental retardation, a field in which legislation has lagged behind.

Dr. Stafford L. Warren, special assistant to the President on Mental Retardation, told the meeting that not only had The Maternal and Child Health and Mental Retardation Amendments of 1963 been signed, but that President Kennedy had also signed an act to increase opportunities for professional training (called H.R. 12), which is now ready for operation.

The Senate bill (S. 1576) creating mental retardation facilities, community mental health centers and special education programs was later signed by the President.

Of immediate importance, Dr. Warren said, is the fact that the bill "provides planning funds for the governors who must appoint an interdepartmental commission or designate an agency within the state government as sponsor for the mental retardation program."

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Do You Know?

The largest galvanizing *mill* in the U. S. can produce 300 feet of zinc-coated sheet steel per minute.

More than two-thirds of all the *meat* and *milk* in the world is consumed by less than one-fifth of the world's population.

A *helicopter* has been developed with a detachable van that can be converted to serve as a portable field hospital, survey station or command post.

The 350-foot-tall Saturn V moon *rocket* will put out more low frequency sound than any other source in the U. S., including Niagara Falls.

Female *flies* attract males by means of a chemical substance they produce.

• Science News Letter, 84:301 Nov. 9, 1963