

NIKE ZEUS— MISSILE KILLER!

THE LATEST U.S. ANTI-MISSILE MISSILE IS NOW A
COMPLETELY AUTOMATED, AND DEADLY SHARPSHOOTER

By LAIRD HARDING

A NIKE ZEUS AMM (anti-missile missile) shot it out for the eleventh time with an Atlas ICBM (intercontinental ballistic missile) on the 5,000 mile Pacific Missile Range. The first intercept, on July 19, 1962, was one of the greatest days in the history of weaponry.

Poised in its concrete silo on the Pacific island of Kwajalein, the lithe and lethal Nike Zeus waited for the Atlas to blast off its launching pad at Vandenberg AFB near Point Mugu, California, and come streaking half way across the ocean at over 16,000 miles per hour. About 30 minutes later, indicators in both missiles announced that the Zeus had again scored a bull's eye!

Both protagonists in this mighty duel, high above the waves, were named after the mythological gods of the ancient Greeks, though the Pentagon could have named this AMM the "Wes Hardin," after the gunfighter who, decades ago, allegedly gunned down a desperado who had a pistol pulled on him with the hammer cocked. This the Nike Zeus is called upon to do, and does it phenomenally well. The incredible reaction times of the professional gunslinger, or an Ed McGivern are as slow as a turtle wading through molasses when stacked up against the new hypersonic rocketry.

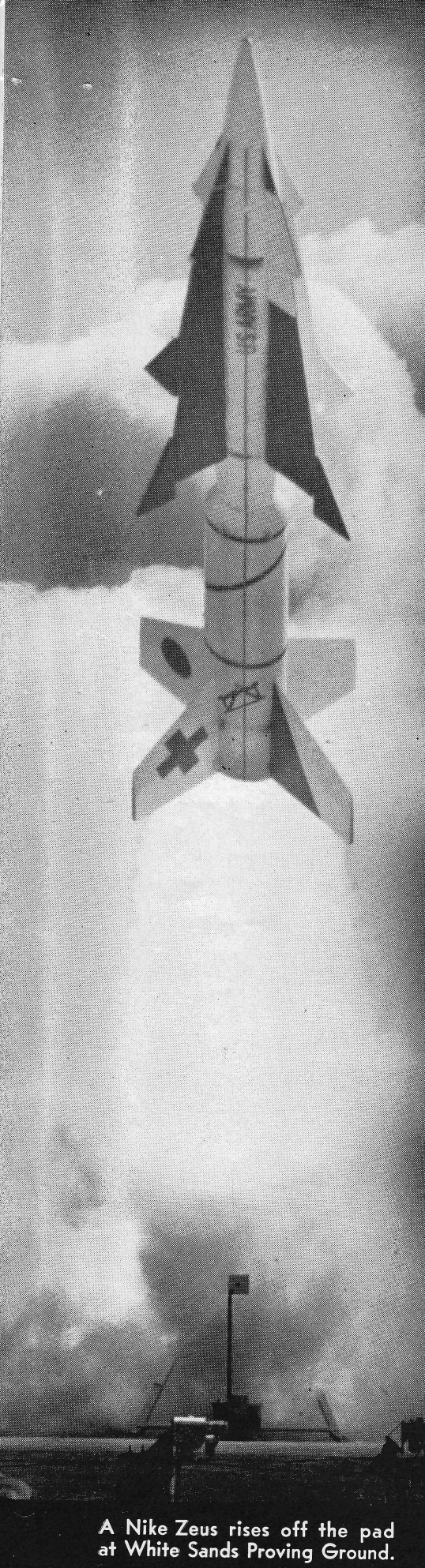
When the Nike Zeus won the military's "fast draw trap shoot" in the mid-Pacific, the world's first completely automated weapon system made its successful debut. Neither automatic nor a weapon, in the traditional sense, the Zeus Defense Center is a fully automated weapon system which—without human help—spots intruding hypersonic ICBM's; determines speed, trajectory, point of impact; rejects decoys; assigns each incoming warhead to one of its many "birds;" launches it without outside aid; calculates lead and guides it to the cataclysmic intercept with closing speeds above 25,000 miles per hour, or 36,960 feet per second.

Since 1955, when Bell Laboratories completed feasibility studies, \$1.5 billion has been spent on the Zeus with the result, according to the experts, that "its operating parameters (speed, range, intelligence, accuracy) are incredible . . . The sheer magnitude and complexity of such a system is enough to make its successful development seem impossible even to the initiate." Recently, an additional rocket, the Nike X "Sprint," faster and smaller, has been added.

Zeus, the third generation Nike, is a solid propellant rocket over 48 feet long, with its 3 stages packing 450,000 pounds of thrust to produce extreme acceleration at blast-off to reported 7,200 mph necessary to kill ICBM's which have re-entry speeds over Mach 15. (Mach number is the ratio of flight speed to the speed of sound—761 mph or 1,116 fps. Thus, the Army 30-06, at 2700 fps, travels at Mach 2.4.)

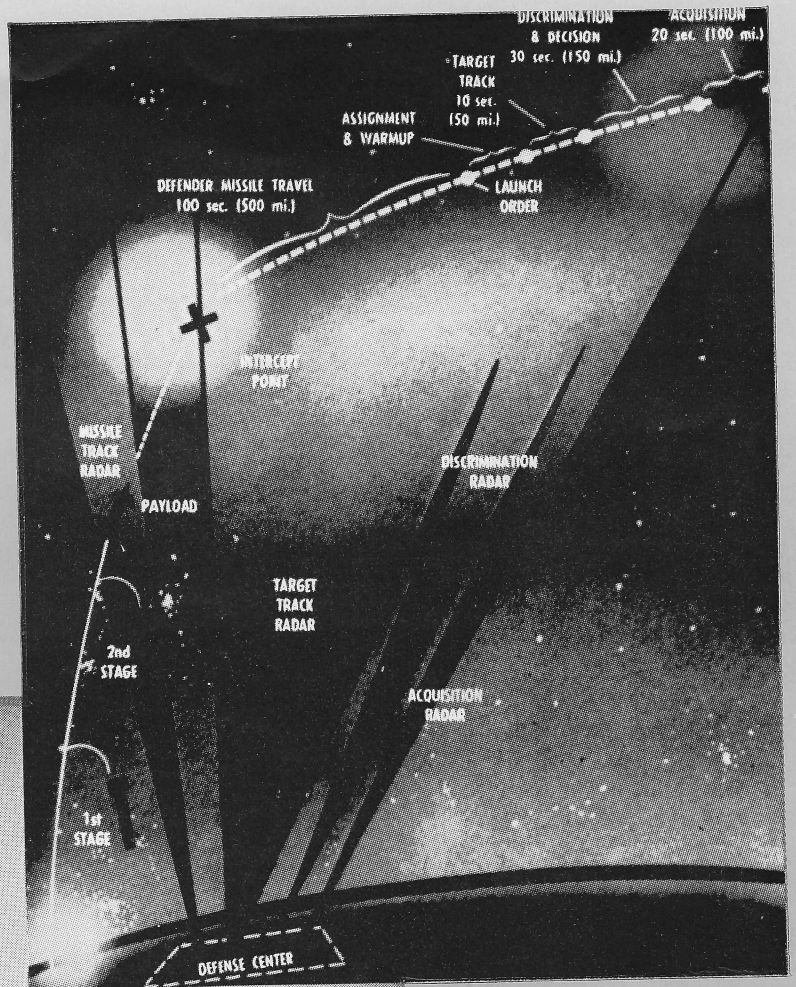
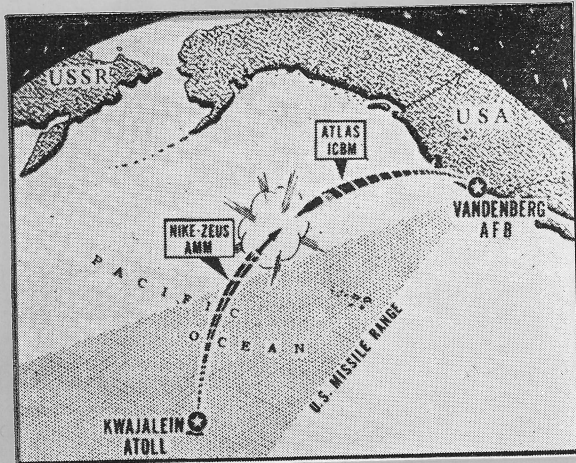
An early Western Electric announcement about the "bullet that will hit a bullet" explains why the Zeus had to be automated:

"The Nike Ajax and Nike Hercules systems were supplemented by human beings who determined: 1—whether or not the sighted (*Continued on page 60*)

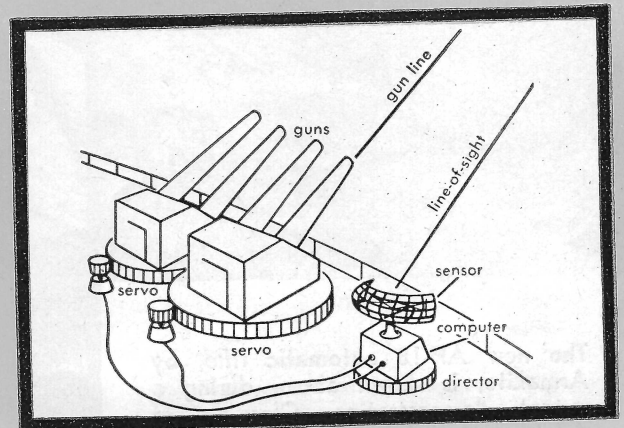
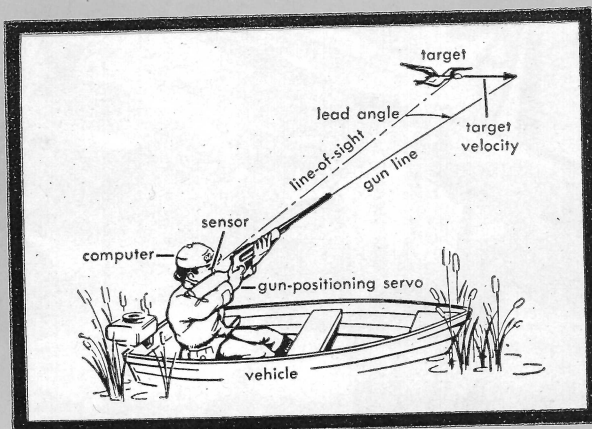


A Nike Zeus rises off the pad
at White Sands Proving Ground.

The world's largest "sneet" layout spans the Pacific Ocean. "Claybird" is a deadly ICBM.



Above, graphic sketch shows Nike Zeus reaction time. At left, the Nike family poses for a portrait: from left to right, Ajax, Hercules, Zeus.



Text compares a hunter-scattergun-duck system to a semi-automatic anti-aircraft weapons system.

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(Continued from page 23)

object was an enemy or a friend; 2—whether or not to fire at the target; 3—when to fire at a target; 4—how many missiles to fire at a given target; 5—which battery should attack a target; 6—whether or not target was destroyed. These human beings contribute to the defensive missile system one thing vital to a successful defensive operation: logical decisions which direct the efficient utilization of the defense.

"In the Nike Ajax and Nike Hercules systems it was feasible to use human beings for this purpose. However, the nature of the ICBM, that is, its tremendous speed, requires instantaneous and effective decisions to be generated with such speed and of such a degree of correctness that the human being's ability to supply them has been surpassed. In effect, we must substitute for the human brain an electronic brain capable of resolving instantaneously in the logical manner, all of the problems of decision as to how, when, and in what fashion to employ the defensive capabilities."

To understand the Zeus System, let's first take apart what it supersedes. The factors in the obsolete soldier-gun "system" are pinpointed in the schematic drawing on page 23. Here, the duck hunter is about to bag a 60 mph mallard with an "automatic" shotgun. The "sensor" (his eye) identifies the "target" as Sunday dinner material (i.e. not

a stray crow) and then, working with the "computer," gauges range, elevation, velocity, and lead. The results are telegraphed to the central nervous system which initiates and coordinates complex muscular and skeletal movements comprising the "gun-position servo" and weapon actuator. Years of trial and error and learning provide the "feedback" among all system elements required to bring home the legal limit.

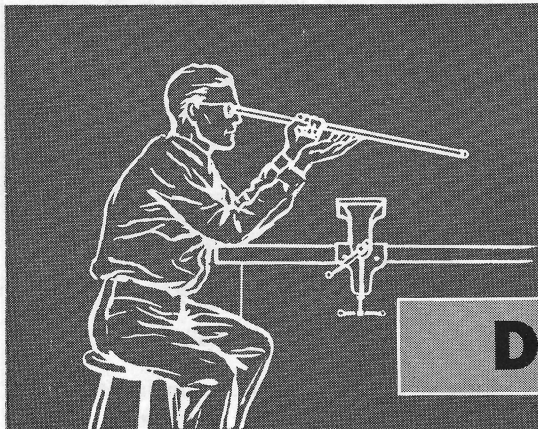
Let's distinguish between automated and automatic. Automation is the substitution of scientific devices—mechanical, electrical, chemical, electronic, etc.—for human observation, decision, and effort. Automatic, as it applies to firearms, refers to a weapon's ability to self-load; fully automatic when holding back the trigger results in a continuous stream of bullets. A fully automated weapon system is one which operates without human interference, from target detection and discrimination to kill. (The most common automated gadget is the household oil burner.)

What ties together the rifleman's "sensor," "computer," and "servo" is a complex organism composed of specialized, interacting cells held together by skeletal muscles. His skull houses the 15 billion cell brain which receives, interprets, and organizes messages from the senses (eyes, ears, etc.) along intricate nerve pathways and then controls and

coordinates body movements and reactions. Hitting a duck calls for good sensory acuity and involves thousands of signals and movements of great complexity, precise timing, and synchronization. The hunter does his part by practicing enough to sharpen up the required refinements of judgement, reaction, and muscular control.

Originally, the military came up with semi-automated weapons, as in WW II automatic anti-aircraft guns. In the diagram on page 23 we see this applied aboard a ship in a manner similar to the Army's 75 mm "Sky-sweeper." Requiring manual control, this development featured electrical gun positioning based on computer fire data supplied by radar, plus automatic loading; all beefing up and extending the soldier's senses and muscles.

Now, let's look at the Zeus Defense Center System, a vast complex sprawling across more real estate than three or four Pentagon Buildings. The receiving antenna of the Acquisition Radar is a huge hemisphere 100 ft. in diameter, filled with 42 box car loads of plastic foam laced with metal slivers. Its transmitting antenna is as large as a baseball infield. Surrounding this is a 65 ft. high metal fence to shield personnel from the powerful radiation. The Discrimination Radar does the impossible: it studies incoming nosecones and picks out phony decoys sent along in a saturation salvo to confuse the defense. The massive Target Track Radar has a needle-thin beam for precision following of the hostile warhead. Guiding the AMM to intercept point is done by the Mis-



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sile Track Radar. The major brain and central nervous system, with 20,000,000 connections and untold miles of wiring, is the Target Intercept Computer, coordinating the heavy flow of data among the radars, and directing each "bird" to the lethal burst. It's a super-speed electronic brain capable of 200,000 arithmetic operations per second.

How does this gigantic array of electronic superlatives duplicate a live gunslinger and then proceed to handle a sharp-shooting chore far beyond mere mortal capacity? The diagram at the top of page 23 presents it in detail, and clocks the Nike Zeus "fast draw." The chart assumes warhead speed of 18,000 mph, interceptor speed of 7,200 mph and target acquisition beyond 850 miles. Thus, the nosecone is darting in at five miles per second or Mach 23 (about ten times faster than a .30-06 slug), while the Zeus is shooting up at 2 miles per second, or about Mach 10.

Here's what happens. The broad beamed Acquisition Radar, the most powerful in the world, ceaselessly sweeps hundreds of millions of cubic miles per second. It "acquires," or picks up, an incoming enemy missile hurtling earthward from its 600 to 1,000 mile apogee (high point) when the intruder bounces back a signal to the domed receiver. These impulses are translated into fire control data and fed into a "brain" which computes target track and point of impact and asks the Discrimination Radar whether it's a dummy or the real McCoy. The DR beam latches onto the object and sends its electronic picture to a Rogue's Gallery in the memory part

of the "brain" which checks it out as being a lethal warhead in 3 micro-seconds. Alerted, the Target Track Radar beam locks onto the real warhead and feeds continuous data on its position to the Target Intercept Computer. Calculating instantly the intercept point, this "brain" selects a rocket, warms it up and blasts it off. Then, the last radar follows it and provides command guidance, controlling the Zeus until it is ordered to detonate, destroying the target.

Recently, Western Electric received a \$213,385,000 contract to develop the Nike X System with faster computers, sharper radars, and the souped-up Sprint, adept at low altitude interception. Eventually, the Nike Zeus and Nike X will merge into a second generation system with greatly enhanced capabilities for handling the missile threats of the 1970's.

"In the beginning," says *Army Information Digest*, "the problems in ballistic missile defense seemed appalling in their enormity." Solving them became "one of the most complex Research and Development jobs ever undertaken." Today, the project is "accelerating toward the point of production decision."

Will the next war—if it ever comes—be a war of robot fighting robot, slugging it out intercontinentally, with the foot soldier watching it all on TV as envisioned by the science fiction writers? Could be. We have our first military robot, and it works. GUNS salutes the "fastest guns alive," Uncle Sam's Nike Zeus and Nike X.

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