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FEATURING

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TIME WAITS FOR WINTHROP
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HOW DO WE STAND IN THE SPACE RACE?
Read
OUR MISSILE ARSENAL
By
WILLY LEY

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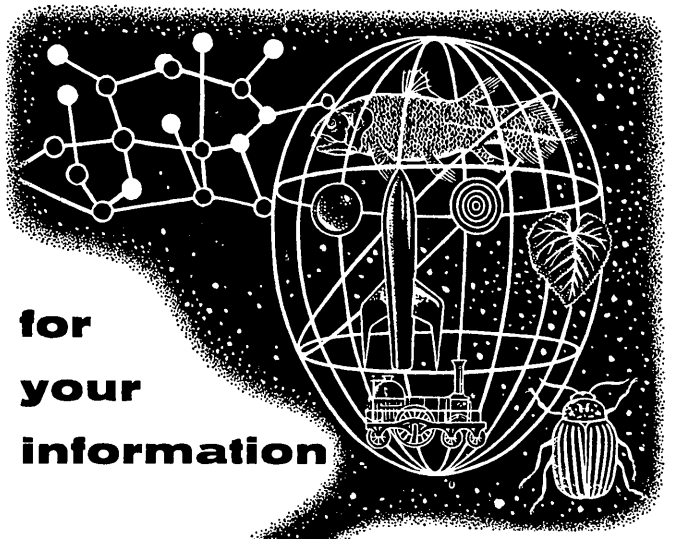
AND
OTHER STORIES



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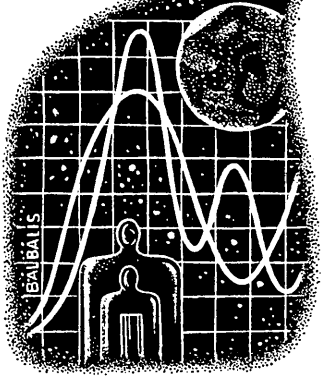

OUR MISSILE ARSENAL

By WILLY LEY

SINCE ten to twelve weeks go by between the writing of this column and its appearance on the newsstands, I am going to make the cautious remark that the following observation may no longer be true by then. (But I doubt it.) The obser-

vation is that most of the things I have been reading in the daily press about missiles during the last few months mostly dealt with missiles that don't yet exist. Or which are, at least, very much unfinished, if you consider the production contract the finish line.

There have been a good many articles about the Air Force's Project Atlas, aimed at creating a ballistic missile with a range of 5000 miles. There has been just as much discussion about the Thor missile, which is to have a range of between 1000 and 1500 miles.

Since this is now considered an "intermediate range," the Thor bears the designation IRBM. The Atlas is called the ICBM.

There have been other articles about a Navy project to create a ballistic missile that can be fired from a submarine without the need for surfacing.

If a newspaper reader, duly digesting and memorizing all this, should arrive at the conclusion that we apparently don't have much worth mentioning *right now,* he would, of course, be wrong. But he could hardly be blamed.

LOOKING over the photographs which accompany this article reminded me of Ordnance Day on the Aberdeen Proving Ground in the Fall of 1956.

It happened to be one of those days when the rain stopped to give the drizzle a chance; in fact, the weather was such that the commanding general said at one point that they were "showing all-weather equipment, demonstrated by all-weather soldiers to an all-weather audience." However, it wasn't really so; it wasn't "all weather"— it was just all kinds of rain. Maybe it was because of this weather that something very significant did not strike me until I woke up the next morning.

In former years, the audience left the Proving Ground trying to get its ears back in shape because of all the gunfire that had been going on.

I remember one such occasion when tanks fought a sham battle which was just as noisy as a real one. Then a flight of jets came in at what seemed to be twenty feet over the bleachers and helicopters rattled down to evacuate the "wounded." Elsewhere, 90-millimeter anti-aircraft guns spit smoke balls into the sky, and when the "enemy" tanks had finally been beaten off and were in retreat, a battery of 280-millimeter guns opened fire on them to make them stay retreated.

After Ordnance Day, 1956, ears kept ringing not with the thunder of guns, but with the roar of rockets. I don't mean to say that no gun was fired — a few guns

and mortars and even machine guns went off.

But what everybody remembered was the missile arsenal, the gigantic Redstone rocket which had been brought in and erected, the Corporal on its launcher, the Nike battery in the distance.

Everybody remembered the five-second salvo of 64 bombardment rockets which demolished something far away. And the Dart missile which pursued a speeding tank just above the ground and smashed through the center of a big target on top of it. Two enormous Honest John rockets roared into the air to drop 24,000 yards away in some presumably desolate "impact area." One of Honest John's small brothers, named Little John, was fired.

It was rockets and missiles, missiles and rockets all day long.

We do have a missile arsenal in working order. As a matter of fact, we have three, one each for the Army, the Navy and the Air Force. However, I am not going to list them according to the Service, but will go by engineering features, beginning with the liquid-fuel rocket-propelled missiles.

THE biggest one in production is the Army's Redstone, which stands nearly 70 feet tall, with a body diameter of almost six feet. The Redstone is not a two-stage, but rather a two-part missile, consisting of a front section which houses warhead and guidance, and an afterbody which houses the fuel tanks and the rocket motor with auxiliary equipment such as fuel pumps. The end of the front section is indicated by the little square fins.

Somewhere along the descending leg of the trajectory, the forward section separates from the afterbody and it seems likely that the forward section can still make some minor trajectory corrections after separation.

The fuels of the Redstone are liquid oxygen and ethyl alcohol, and almost everything that hasn't been mentioned yet is classified information. The range is noncommittally stated to be 200-plus miles, the takeoff weight is classified (but said to be about 40,000 lbs.) and the weight of the payload is a secret. It must be enormous, for the 200-mile V-2 carried a warhead weighing one metric ton and the Redstone is so much bigger.

The next in size among the liquid-fuel rockets is the Army's Corporal, which stands 45 feet tall, has a body diameter of 30 inches and a takeoff weight of about 12,000 lbs. The fuels are red fuming nitric acid and monoethyl aniline. Control is by means of vanes in the exhaust blast. The

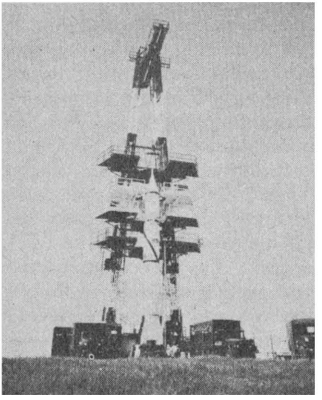

Fig. 1: The Redstone missile.

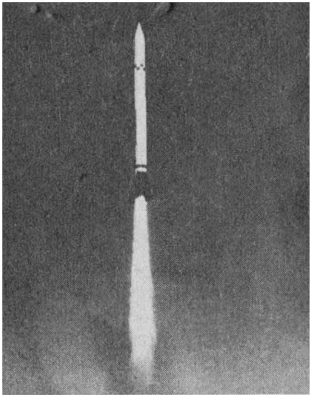

Fig. 2: Corporal missile taking off.

range is only 50 miles, but the payload capacity is good enough for an atomic warhead and the Corporal is said to be extraordinarily accurate.

Because some dimensions are still classified, I am not sure which missile is the next in size. Going by weight (classified, too), chances are that it is the Rascal of the U. S. Air Force. So far, only one retouched photograph has been released, but it is known that the Rascal is an air-to-ground missile developed by Bell Aircraft. Total length of the airplane-shaped missile must be about 35 feet.

A British aviation magazine added some more information. According to this source, the Rascal missile, fueled by liquid oxygen and jet fuel, has a weight of about 13,000 lbs. and is carried up by a bomber, say a B-52. It is then released at some distance from the target, which may be as much as 100 miles. After release, the Rascal first climbs to 100,000 feet, where jet-propelled fighters cannot get at it, and then, after navigating itself to the target, dives in. The warhead can be atomic.

NEXT come two anti-aircraft missiles (both Army), the Nike Ajax and the Nike-Hercules, formerly called Nike B. Nike Ajax is the one first just called Nike and then Nike-A. It is a liquid-fuel rocket 20 feet in

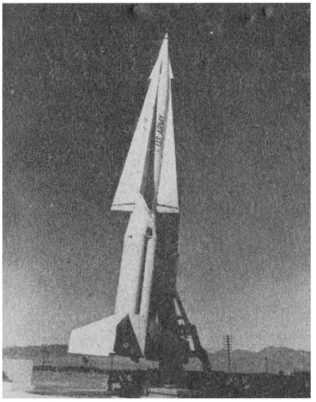

Fig. 3: The Nike-Hercules on its launcher.

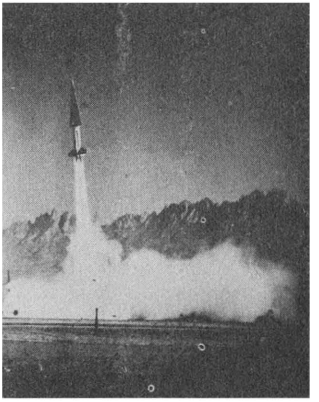

Fig. 4: Nike-Hercules taking off.

length, with a 15-foot solid-fuel booster to get it into the air fast. The fuels for the rocket are red fuming nitric acid and gasoline; its weight (without booster) is 1500 lbs.

Nike Ajax is the one which is now scattered all over the country near large cities. Its operational slant range is 18 to 23 miles and the flying time to maximum range 80 to 110 seconds. Nike Ajax is a so-called beam rider, which means that it follows a guiding beam to the target.

Nike-Hercules is the big brother to the Nike-Ajax. The booster seems to have been put together from four Nike boosters. The rocket is bigger, too. In fact, it is big enough to carry an atomic warhead, the thought being, of course, that an atomic explosion in the midst of an enemy bombing formation will wipe out much more than just one plane.

The Navy's Terrier is a ship-based anti-aircraft missile with an overall length of nearly 27 feet. Unlike the Nike Ajax, the Terrier is a solid-fuel rocket with a solid-fuel booster, but is also a beam rider. The maximum operational slant range is said to be 20 miles.

Going on with solid fuels, a non-missile must be mentioned first—the Army's Honest John. It is not a missile that either can be guided or will guide itself after takeoff; it is very simply a large bombardment rocket.

Fig. 5: Anti-tank missile Dart.

And heavy artillery it is: 27 feet 3 inches long with a takeoff weight of 6000 lbs. and a warhead weighing 1500 lbs. The diameter of the warhead is 30 inches, the diameter of the body 23 inches. Its fuel is a single-piece cast solid charge. The operational range is 30,000 yards.

When fired at a very shallow angle (elevation 11 degrees), the peak of the trajectory is only 900 feet above the ground and is reached in nine seconds. Impact for the firing angle takes place after 16.5 seconds at 10,000 yards. For a 50-degree elevation, the peak of the trajectory is 30,000 feet, attained after 41 seconds, and impact at 30,000 yards after 87 seconds.

The Air Force's Sidewinder does not show any external semblance to the rattlesnake after which it has been named and its anatomy is not the same, either. Still, there are some resemblances.

The Sidewinder missile is carried by aircraft as a weapon against other aircraft. It is about nine feet long and probably weighs 150 lbs. In its nose, it carries a heat-seeking homing device. When fired in the general direction of the target, the Sidewinder senses the heat of the target's engine and steers itself into the source of that heat.

It has been said that if there were only one man on an open desert at night, a Sidewinder would find him. And if he ran into his house, slammed the door

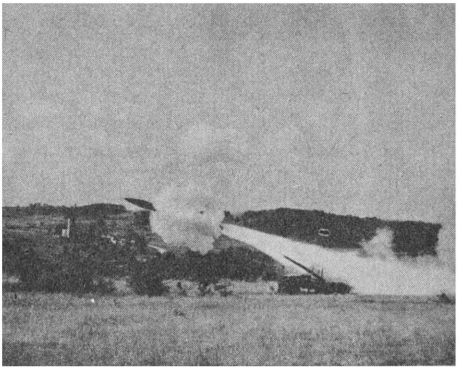

Fig. 6: Honest John rocket taking off.

and hid under the bed, the Sidewinder would come in through the window and join him. This story may have been invented by a Texan, but he probably did not have to exaggerate much.

THE Air Force's Falcon is another one of these homing missiles. It is six feet six inches long and weighs about 120 lbs. Like the Sidewinder — which is also used by the Navy — it is a solid-fuel rocket.

So is the Navy's Sparrow, an eight-foot air-to-air missile with a weight of 300 lbs. and a range of five to seven miles. The Sparrow is not a homing bird, however, but a beam rider.

One Army missile revealed as "ready" only a very short time ago is the Lacrosse, a solid-fuel missile with cruciform wings that have a wing spread of not quite four feet. The operational range of the Lacrosse is eight to ten miles.

The last one on the list of solid-fuel missiles to be mentioned is the little Dart, which, for demonstration purposes, is usually fired from an open small Army vehicle. (In combat, I should think, they'd probably be hiding somewhere.) It is a destroyer of ground targets, mainly tanks but also pillboxes and, possibly, the means of taking a support away from a bridge.

Like the Lacrosse, the Dart has cruciform wings. Its guidance is by wires, an idea first employed by the builders of experimental

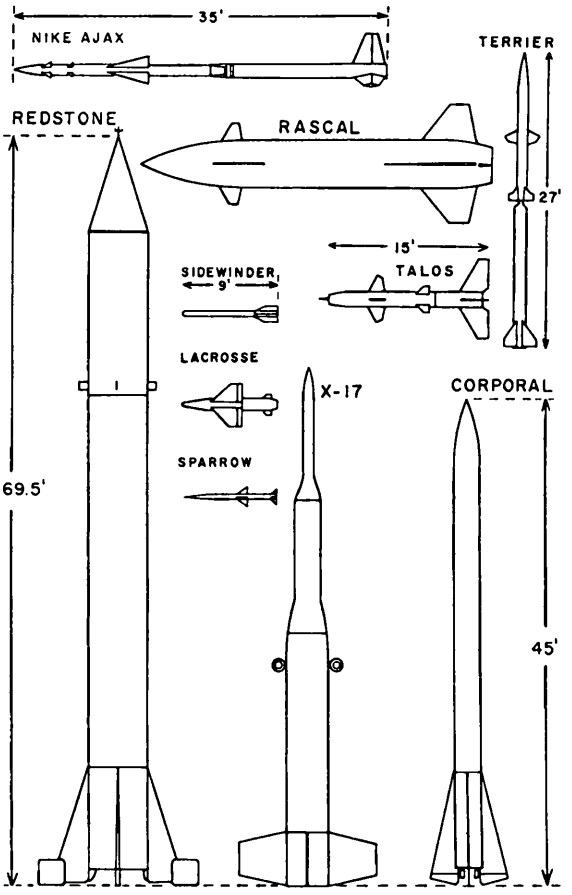

Fig. 7: U. S. Missile Arsenal, (From the Revised Edition of Rockets, Missiles and Space Travel — Courtesy The Viking Press, Inc.)
All photographs "Courtesy U. S. Army"

naval torpedoes during the so-called gay nineties and later developed by the Germans during World War II. The German device which was to use it was the air-to-air missile X-4, which has acquired some historical fame as being the smallest liquid-fuel rocket missile ever attempted. It flew, but did not get into production.

On two opposing wings, the X-4 carried flares, just to make it more visible to the man who fired it. On the other two opposing wings, the X-4 carried two bobbins containing a mile or so of thin copper wire which unreeled as the missile progressed. The command impulses came to the missile through these wires, making any "jamming" impossible. The Dart uses a method based on the same idea; detail has not been released, of course.

The next "family" of missiles is the one that is characterized by having air-breathing engines like turbojets and ramjets. They seem to be in special favor with the Air Force and the largest of them is the intercontinental *production* missile, the Snark, of which most citizens heard for the first time when one flew to Brazil.

The Snark is an airplane-shaped missile — you might just as well say a pilotless jet plane — with an overall length of 74 feet and a wing span of 42 feet. It is powered by a turbojet engine and catapulted into the air by two solid-fuel takeoff units, each of which delivers 33,000 lbs. of thrust.

Apparently the testing (or training) procedure with the Snark is to have it take off from Patrick Air Force Base in Florida and fly in a straight line down the missile range leading over the Bahamas and Puerto Rico. After 2000 miles or so, the Snark executes a pretty 180 degree turn and it is likely that there is a method of landing the missile when it comes back. The one that got all the publicity simply failed to make that turn.

NEXT one in size is the Air Force's Bomarc missile, which is 39 feet long, has a wing span of 19 feet and a cruising speed of two and a half times the speed of sound, but a comparatively short range of a few hundred miles. The Bomarc is powered by two 28-inch-diameter Marquardt ramjets with 10,000 lbs. of thrust each.

While the Snark is to destroy ground targets, the Bomarc is an anti-aircraft missile, but just how it goes about destroying aircraft is a matter of conjecture. One source guesses that this fighter-sized missile carries an atomic warhead like the Nike-Hercules. Another one says that the Bo-

marc is a missile-carrier itself, going into action with a load of Falcon missiles.

There are no such secrets about the next missile, the Air Force's Matador, also a pilotless bomber meant to destroy targets on the ground. The 46-foot-long Matador, with a wing span of nearly 29 feet, is powered by a turbojet and takes off with the aid of one large solid-fuel booster rocket. The operational range is 600 miles.

The Navy's equivalent of the Matador is the Regulus, of which there are now two versions, one subsonic, the other supersonic.

The subsonic Regulus is turbojet-powered and takes off with the aid of two solid-fuel boosters. It is 32½ feet long with a wing span of 21 feet. It can either be command-guided or be equipped with homing guidance. The warhead is a nuclear warhead, as in all large missiles.

Regulus II, the supersonic variety, seems to be just a bigger and better Regulus with a more powerful jet engine and a longer range.

The range of the first Regulus (I very narrowly missed writing the regular Regulus) is given as around 500 miles.

Whether the Navy's Petrel should be listed here or not is somewhat doubtful — it may still be under development and then again it may not. At any event, the Petrel is a missile which is dropped by aircraft for the purposes of hunting submarines. The length is given as 24 feet, the wing span as 13 feet, the weight as 3800 lbs. and the range as five miles. Propulsion is by a small turbojet engine. The warhead is high-explosive, not atomic.

The list ends with an air-breathing missile which is used, in slightly different versions, by all three Services, the Talos. It is a supersonic anti-aircraft missile about ten feet in length, powered by an 18-inch-diameter ramjet engine. A solid-fuel rocket booster gets it going. It is probably a beam rider and the operational slant range is at least 50 miles.

THIS completes the list of the missile arsenal we have. But this being a science fiction magazine and its readers being what they are, I know that I am expected to say at least a few words about what is being developed now.

Well, the Navy is thinking about or working on:

(1) the Polaris, intermediate range solid-fuel fleet missile that can be launched from submerged submarines.

(2) the Triton, a ramjet-propelled missile that might be

described as a super-Regulus of 1500 miles range.

(3) the Lulu, of which it is known that its warhead will be nuclear and its purpose the destruction of submarines. Everything else is either secret or not determined.

(4) the Dove, of which nothing has been said.

As for the Army, it is working on:

(5) the Jupiter, of which it is known that it is big. Period.

(6) the Shrike, of which it is known that it is a liquid-fuel rocket with a nuclear warhead.

The Air Force has the longest list of missiles under development, namely:

(7) the Atlas, of 5000 miles range with hydrogen warhead.

(8) the Titan, of similar range, known to use liquid fuels.

(9) the Thor, of 1500 miles range, using liquid fuels.

(10) the Navaho, of which several versions are under development, ramjet-powered.

(11) to (??) of which nothing has been said. Some of the things you read may just refer to different Navaho versions. Others are probably pure research missiles. Still others could be anti-missiles to take care of intercontinental missiles. And it has been known to happen that a "development" was mostly the hopeful talk of somebody thinking about contracts. But it has been officially said that the Air Force has handed out several study contracts dealing with an unmanned rocket to the Moon.

BUT what is the X-17 on the drawing? The X-17, built by Lockheed, is a pure research missile.

The first stage is a liquid-fuel rocket which has spinner rockets attached near its top that provide a rapid rotation for the whole soon after takeoff as a stabilizing measure. The second stage, a so-called "cluster" of solid-fuel rockets, then carries the third stage out of the atmosphere. The third stage is supposed to turn over outside the atmosphere prior to ignition and then push itself vertically down so as to enter the atmosphere as fast as possible.

The purpose of the whole thing is to find out what happens to a missile when it re-enters the atmosphere from space.

This is something we must know – not only for missiles, but especially for the day when a pilot's ship "re-enters" from space.

— WILLY LEY