Galaxy
SCIENCE FICTION

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THE WIND BETWEEN THE WORLDS

By Lester del Rey

Safe While at Rest: Commander Bill Talbot (Glenn Ford) leans casually against a *Loon* flying bomb

Missiles Over the Sea

BY WILLY LEY

Filmed in cooperation with the U. S. Navy, Columbia's film *The Flying Missile* reveals hitherto restricted data on rocket weapons.

I AM not in the habit of writing what may be called a movie review, but on occasion it does happen. In fact, I remember all three occasions. The first discussed *The Lost World,* the second was about *Frau im Mond,* and the third analyzed *Destination Moon.* This is number four—the title of the film, in this case, is *The Flying Missile.*

It concerns, as the title makes unmistakably clear, missiles, and specifically the U. S. Navy's *Loon.* More generally, it tells of some of the things which go on at the Navy's closely guarded Guided Missile Center at Point Mugu, near Oxnard, California, an hour's drive along the coast from Santa Monica.

But it is not a documentary film; it is a full length feature with the

primary purpose of entertainment. This, of course, will appeal to a few million people who would not look at a documentary film—on missiles or other things—even if admission were free. In this case, the fact that it is not principally a documentary film carries an almost unsuspected advantage. Being "fiction," it does not have to stick strictly to the things which have been done, but, like a science fiction story, it can look ahead a bit toward possible application.

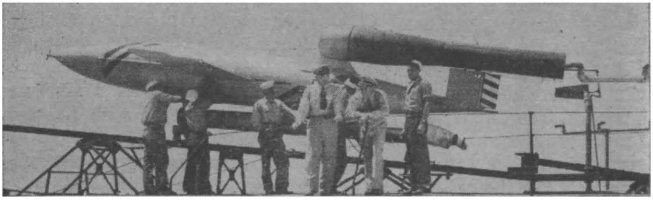
Though the underlying problem is a military one, the film story is devoted partly to a human problem, partly to what might be called "story line." The latter consists of the efforts of a submarine skipper and his crew to get around, and especially ahead of, the guided missiles instruction courses they are subjected to at Point Mugu. They *thought* they could pick up a few missiles and experiment with them, preferably aboard their own submarine. Instead, they have to learn about the various types of missiles, how they are tested, how they work, the theory behind guiding, etc., etc. So they "obtain" without being detected—they think—the parts which make a launching rack for a missile, and put it together, only to discover in the end that no missiles happen to be available and that one cannot get around Navy Channels but has to go through them.

The other story, the human problem, is hinged around an accident which kills one of the crew and injures the skipper, paralyzing his legs. He does not recover because he does not *want* to recover; it needs the combined efforts of his superiors, his girl and, most important, the sight of his ship to make him capable of going back to the job he started.

PERSONALLY, I was, needless to say, mostly interested in the underlying military problem, which is an actual one. Also an acute one, created not so much by the "guided" missile, which, to the untrained mind, is particularly dangerous because it can be aimed—but the sheer existence of any long-range missile at all.

Only ten years ago, there was still some simplicity left in naval warfare. Unless an enemy aircraft carrier was around, a shore installation was safe from attack as long as the enemy warships were more than 10 miles away—20 miles in the case of a heavy battlewagon. The safety was, actually, far greater than that because the number of both heavy battleships and large aircraft carriers of any enemy is restricted and their movements are carefully checked and known.

Here a factor came in which is rarely mentioned except, maybe, in courses at the War College. That is the relationship between striking range on the one side and detecting range on the other. For some



With four jato takeoff units, the Loon, improved version of V-1, needs a launching ramp only slightly longer than itself

time a battleship had a longer striking range than its intended victim had detecting range. In other words, the ship could shoot over a longer distance than it could be seen.

In reality, that fact may never have made a difference, but it is important now.

Striking range in both naval and land warfare fell far below detecting range in the First World War, when aircraft was employed for observation purposes. But visual detection, whether from the lookout of a ship or from the cockpit of an airplane, is still hampered by weather. Much could go on under the cover of fog or rain which would not have gone undetected in fine weather.

This is one of the reasons why the submarine, although a highly vulnerable type of vessel, became so important through two wars. The striking range of a submarine is short; its guns carry, on the average, hardly more than six miles. That is also the maximum range of a naval torpedo, but you rarely hit anything which is more than 2,000 yards away. But the submarine had the enormous advantage of being able to approach unseen. Long and sad statistics prove that the striking range of a submarine, though short, was still longer than the victim's detection range.

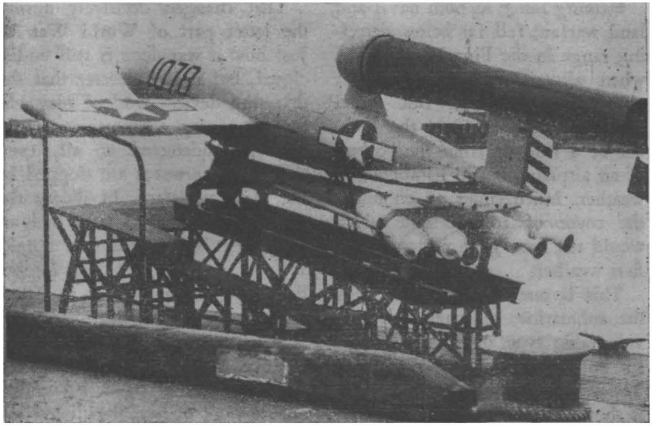
That changed decisively during the latter part of World War II. Just how it was done is still undisclosed, but it is no secret that the detecting devices work. I may add that, *in theory*, a submarine should not go undetected at all, even though radar waves are stopped by the water's surface. In theory the case is that we have a large body of a homogeneous liquid (sea water) with a non-homogeneous foreign body (the submarine) in it. There *should* be a physical principle which betrays both existence and location of that body, even if no engine makes a sound, no detectable amount of heat is radiated and every member of the crew holds his breath.

THE basic idea of the movie is built on this complex of facts. An "enemy" carrier, equipped with V-2 type long range rockets with atomic warheads, is approaching the coast. The carrier is far below the horizon, hence far out of radar range, since radar waves, naturally, do not follow the curvature of the earth. But the coast is within range of the carrier's missiles. (Actual range for a V-2 is 190 miles; missiles for twice that range can no doubt be built.) The only possible defense consists of sinking or at least seriously crippling the carrier before it can fire the rockets. That job is entrusted to submarines which are to torpedo the carrier.

But the detection range of the carrier with its accompanying destroyers is far greater than the striking range of the subs. None of them can come close enough to strike. Which makes a frustrated submarine skipper wish he could fire missiles, too, so that he can strike from outside the detecting range.

Of course the missile suited for submarines as they now exist is not the V-2 type of liquid fuel rockets, but the V-1 type of flying bomb.

To keep the facts straight, I have to mention here that the U. S. Navy has actually test-fired a V-2 rocket from the flight deck of a carrier (the *Midway*) and that numerous small *Aerobee* high altitude rockets and one large *Viking*



Loon, prior to test firing at Navy's Guided Missile Center at Point Mugu, Cal.; the four Jato takeoff units show here

rocket were fired from the converted former seaplane tender *U.S.S. Norton Sound*. The V-2 happened to explode soon after takeoff, but the *Viking* reached a peak altitude of 106 miles. If it had been fired for range, it would have been around 210 miles. The Navy has also fired a V-1 type missile, the *Loon,* from the deck of a submarine.

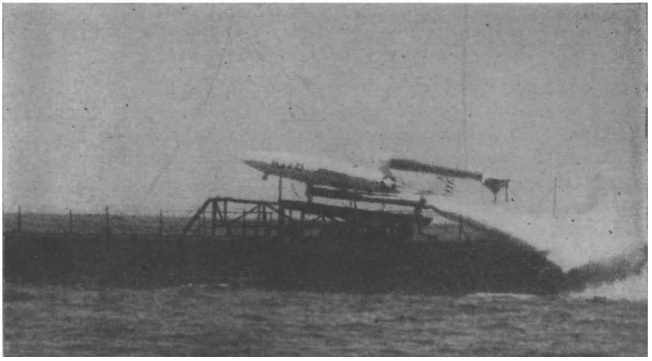
Now the difference between a V-2 type long range rocket and a V-1 type *Loon* goes far deeper than the fact that one is rocket-propelled while the other has a simple pulse-jet engine. It also goes deeper than the otherwise very important fact that a V-2 takes around 18,000 man hours to make and a V-1 only about 1,000 man hours.

The essential difference between the two is that the V-2 rocket travels along a trajectory like an artillery projectile, while the V-1 type has a flight path like an airplane. One may say that the V-1 type relies on the *existence* of the atmosphere for motion, whereas the rocket moves *in spite of* the existence of the atmosphere. Those missiles which rely on the atmosphere have come to be called "cruising missiles." The V-2 rockets should logically be referred to as "trajectory missiles."

THE trajectory missiles are more expensive by far. They require the use of fuels that are not easy to handle. But once they have lifted off the firing table, there is nothing the victim can do but watch them in his radar screen and wonder where they'll hit. It is, by the use of counter-missiles, not completely impossible to knock a trajectory missile off its trajectory, but it is, even in theory, an exceedingly difficult procedure.

The cruising missile, on the other hand, is interceptible. It can be shot down like an airplane by anti-aircraft guns and anti-aircraft rockets. It can be intercepted by fighter planes, which some British *Spitfire* pilots did on occasion without firing a shot. They flew alongside, got their wingtip under the wingtip of the missile, and flipped it over. The piloted plane could easily recover from that maneuver, but the missile crashed. Finally, the cruising missile can be caught by the steel cables of barrage balloons.

Just how interceptible a cruising missile is can be shown with a few figures from the report which the commanding officer of London's air defense, Air Marshal Sir Roderic Hill, drew up after the Second World War, and which was published as a supplement of the official *London Gazette* (Oct. 19, 1948). All in all, it is known from German records, the Germans fired 8,070 flying bombs (V-1) against London. Of these, a number crashed soon after takeoff or strayed off course. A total of 7,488 was reported over England: 3,957 of them were brought down (1,847 by



Actual takeoff of a Loon from the deck of a U. S. submarine; the dense white smoke is that of the solid fuel Jato units

fighters, 1,878 by guns, 232 by balloons); 1,111 fell outside the London target area, which was reached by 2,420 missiles.

But these figures are very misleading in one respect. They are overall figures, which include the early period when defending guns and defending fighters got into each other's territory and hair, and when the anti-aircraft equipment on the ground was not the best available. (No VT fuzes and M-9 gun directors at first.)

The statistics make more sense when drawn up for the various phases of attack and defense during the "Robot Blitz." During the first phase, 42.3 per cent of the flying bombs reported were brought down; then, after reorganization of defense, 58.6 per cent. During the second phase of the attack, the percentage of bombs brought down climbed to 63.2, and, during the third phase, to 72.8.

Quite bad from the point of view of the attacker.

BUT this represented the use of cruising missiles in land warfare, with a fixed target (London), which did not move, and fixed launching installations, the location of which was reasonably well known and the direction of which was precisely known. And when you fire a cruising missile over land, there may be defending anti-aircraft batteries, airports for interceptor squadrons, installations for counter-missiles, and whatever else may be developed, on every square mile.

When you fire a cruising missile over water, there has to be a ship first to do some intercepting. Furthermore, since the ship-mounted firing platform is not fixed, it will be at an uncertain (and changing) distance and direction. If mounted on a submarine, the firing platform can even appear and disappear.

All of which shows why the Army is especially interested in trajectory missiles, while the Navy is paying much attention to cruising missiles. And ever since the V-1 was "naturalized," given its American citizenship papers, so to speak, it has been improved, too.

The original German type needed a launching platform about 150 feet long; the pilots of the RAF called them "ski sites" because of their appearance. The reason was that the pulse-jet engine can work when at rest, but does not deliver any useful thrust. In order to deliver useful thrust, it has to move with a speed of at least 150 miles per hour.

The Germans accomplished that by furnishing the takeoff ramp with a slotted tube. Inside the tube there was a piston with a projection reaching through the slot and hooking into the belly of the missile. The piston was pushed by the rapid decomposition of concentrated hydrogen peroxide, producing steam. The original V-1, after it had lifted off, accelerated to around 360 miles per hour and carried fuel for an average trip of 150 miles. Overall length of the missile was 25½ feet, wing span about 17½ feet.

An installation like one of the original "ski sites" would be terribly cumbersome on shipboard and would also need a large ship to accommodate it. But the Navy has learned to do without such a long takeoff ramp. As a matter of fact, it uses ramps only slightly longer than the missiles themselves!

THE necessary acceleration is now supplied by four Jato solid-fuel takeoff units, attached to the cross bar of a T-shaped structure on which the missile rests. When the Jato units have supplied the initial impetus and the *Loon* moves under its own power, the attachment simply drops off.

The dimensions of the *Loon* are still roughly the same as those of the original V-1, but the range has been somewhat increased. And the speed seems to be higher by about 10 per cent, which makes hitting a missile in flight somewhat more difficult when you fire from below. At the film's combat test in the Pacific, a submarine-launched *Loon* flew through the flak thrown up by a long string of assorted war vessels. Accident, of course, but one which tends to point out the difference between a missile over land and a missile over the sea.

Suddenly, as a result, the submarine has a striking range of over 150 miles. But the radar detection

range is still the horizon, even though it is the horizon as seen from the height of the radar antenna. And the range of the most highly developed submarine detector is not apt to be longer than that; most likely, it will be shorter. The submarine, therefore, can fire some 15 times as far as its detection range, unless aerial reconnaissance is complete and effective. Likewise, the striking range of a big ship, equipped for trajectory missiles, has gone up to 15 or 20 times the probable detection range —reliable radar detection, I mean, which is not influenced by fog, storm, sleet, rain or moonless night.

Of course this, too, works both ways.

The film shows this by repeating the war-game setup of the opening scenes. Again there is an "enemy" carrier with trajectory missiles approaching the coast. Again the defending (and submerged) submarines are handicapped by the discrepancy between their striking range and the carrier's detection range.

But now there is another group of missile-carrying submarines. Being merely converted for this purpose and not designed as missile subs in the first place, they cannot submerge as long as they have their missiles on deck, or, at least, not without ruining the missiles. But they are far out of detection range and their presence is, so far, unsuspected by the carrier.

And the carrier is well within striking range of the missiles . . .

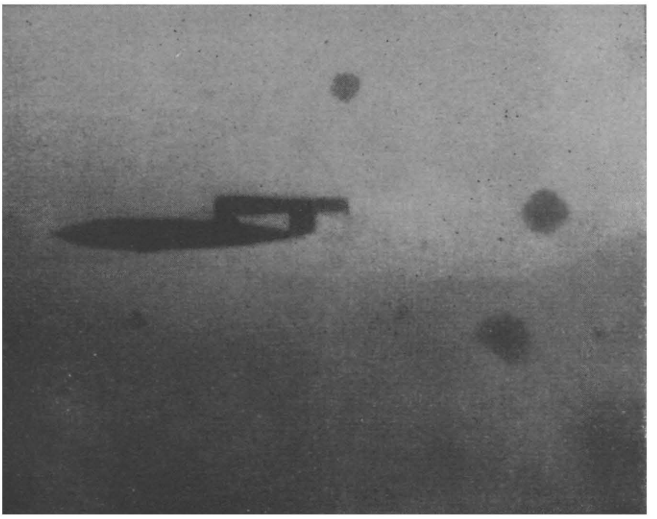
DURING the Second World War, the Germans had a small missile, the Henschel Hs-293, resembling, more or less, a good-sized model airplane. It was carried under the wing of a fighter plane and launched against Allied merchantmen. It was propelled by a rocket unit and guided by radio from the launching plane.

Of course, everybody was well inside everybody else's detection range, and the striking ranges were almost evenly matched. For that reason, the planes had to operate from a distance which was at the extreme limit of effectiveness. Hence they missed as often as not, yet they did account for a number of our ships. (We had a quite similar missile, the *Bat*, in the Pacific.) As became known from captured plans, the Germans were about to improve the performance of this missile by putting a television receiver into the nose.

The end of the war prevented them from finishing that logical development, and the missile may have been too small to be really effective, in any case.

But a missile like the *Loon* definitely is not, and we have both the time and the technology to perfect it. The ingenuity, too, as *The Flying Missile* amply demonstrates.

When I watched the film in a private showing, it was, naturally,



Difficult to hit, a Loon flies through heavy flak thrown up by U. S. warships during naval war games held in the Pacific

with the eyes of an engineer who has worked with rockets, both in theory and in practice, for almost two and a half decades. There is, in other words, little of novelty in them for me, though *The Flying Missile* did reveal certain facts that had been restricted until now and in which I found considerable professional interest.

But if I had seen it 25 years ago, when rocketry still existed only in arid equations on paper, when its supporters were regarded as mental defectives and the moon seemed centuries away . . .

I think I would have seen it every day for a month.

The middle-aged taxpayer, seeing *The Flying Missile,* is likely to reflect that there is very positively something being done with his money at Point Mugu. Others who are still far from being middle-aged, no matter what their years total, will feel the thrill of seeing a dream of science fiction that is solid reality now. And I suspect the film may initiate careers that might have been different.

Mine would not have been.

—WILLY LEY